IR-636633

REPORT NUMBER: 201U-VER-03-7

SAFETY COMPLIANCE TESTING FOR FMVSS 201 OCCUPANT PROTECTION IN INTERIOR IMPACT UPPER INTERIOR HEAD IMPACT PROTECTION

SATURN CORPORATION
2003 SATURN ION 4-DOOR SEDAN

NHTSA NUMBER: C30112

VERIDIAN TEST NUMBER: 8653-FMH-12

VERIDIAN ENGINEERING
TRANSPORTATION SCIENCES CENTER
P.O. BOX 400
BUFFALO, NEW YORK 14225

Date: May 13, 2003

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Safety Assurance
Office of Vehicle Safety Compliance
Mail Code: NVS-220, Room 6111
400 Seventh Street, SW
Washington, DC 20590

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Prepared by: _____

James Czarnecki, Project Engineer

Approved by: _____

David J. Travale, Program Manager
Transportation Science Center

Approval Date: July 14, 2003

FINAL REPORT ACCEPTANCE BY OVSC:

_____

Accepted By

7/22/2003

Date of Report Acceptance

TECHNICAL REPORT STANDARD TITLE PAGE

1. *Report No.* 201U-VER-03-12	2. *Government Accession No.*	3. *Recipient's Catalog No.*
4. *Title and Subtitle* Final Report of FMVSS 201 Compliance Testing of a 2003 Saturn Ion 4-door Sedan NHTSA No. C30112		5. *Report Date* May 13, 2003 6. *Performing Organization Code* VER
7. *Author(s)* Jim Czarnecki, Project Engineer David J. Travale, Program Manager		8. *Performing Organization Report No.* 8653-FMH-12
9. *Performing Organization Name and Address* Veridian Engineering 4455 Genesee Street Buffalo, New York 14225		10. *Work Unit No.* 11. *Contract or Grant No.* DTNH22-99-C-01005
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation National Highway Traffic Safety Administration Safety Assurance Office of Vehicle Safety Compliance Mail Code: NVS-220 400 Seventh, SW, Room 6111 Washington, D.C. 20590		13. *Type of Report and Period Covered* Final Report MAY 2003 14. *Sponsoring Agency Code* NVS-220
15. *Supplementary Notes*		

16. *Abstract*

Compliance tests were conducted on the subject vehicle, a 2003 Saturn Ion 4-door Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure TP-201U-01 for determination of FMVSS 201 compliance. Test failures identified were as follows: None

17. *Key Words* Compliance Testing Safety Engineering FMVSS 201U	18. *Distribution Statement* Copies of this report are available from: NHTSA Technical Information Services (ITS) Mail Code: NPO-230 400 Seventh St., SW, Room 5108 Washington, DC 20590 Telephone No.: 202-366-4946

19. *Security Classif. (of this report)* UNCLASSIFIED	20. *Security Classif. (of this page)* UNCLASSIFIED	21. *No. of Pages*	22. *Price*

Form DOT F1700.7 (8-69)

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SECTION 1

PURPOSE AND TEST PROCEDURE

This head impact compliance test is part of the FMVSS 201 Upper Interior Head Impact Protection Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-99-C-01005. The purpose of this head impact compliance test was to determine whether the subject vehicle, 2003 Saturn Ion 4-door Sedan, NHTSA No. C30112, meets the performance requirements of FMVSS 201, Occupant Protection in Interior Impact. The compliance test was conducted using the requirements found in the OVSC Laboratory Test Procedure No. TP-201U-01 dated April 3, 1998.

SECTION 2

SUMMARY OF UPPER INTERIOR HEAD IMPACTS

A 2003 Saturn Ion 4-door Sedan, NHTSA No. C30112, was impacted at various locations throughout its upper interior by a 4.54 kg 50th percentile headform. A total of ten (10) impacts were performed in this test series. The target area impacts were chosen by the NHTSA Contracting Officers Technical Representative (COTR). A summary of test results can be found on data sheet 2-1. The ten (10) area chosen for testing were:

AP1	BP1	URBP	RP1
AP3 DRIVER SIDE	BP2	SR2A	RP2
AP3 PASSENGER SIDE	BP4		

The selected impact areas on the test vehicle appeared to comply with the performance requirements of FMVSS 201.

Five Free Motion Headforms (FMH), were used in this test series. All five FMH's were calibrated prior to and after the test series. Calibration information are included in Appendix B. Each FMH weighed 4.54 ± 0.5 kg, and had orthogonal tri-axis accelerometer pack mounted at the center of gravity (c.g.).

A total of three (3) channels of data for each target impact test was recorded on a Keyser Threde data acquisition system. Data plots along with still photographs can be found in Section 3 of this report.

To document each target area impact test, one Kodak Ektapro high speed video camera was placed at various locations to view the headform contact with the selected target areas.

DATA SHEET 2-3

SUMMARY OF UPPER INTERIOR HEAD IMPACT TESTS

Year/Make/Model/Body Style: 2003 Saturn Ion 4-door Sedan

Vehicle Body Color: Silver VIN: 1G8AF52F03Z138200

Vehicle NHTSA No.: C30112 Month & Year of Manufacture: 01/03

Test No.	Target				Approach Angles (degrees)		Velocity (kph)	FMH HIC	HIC(d)*
	Code	X (mm)	Y (mm)	Z (mm)	Horizontal	Vertical			
1	AP3	2543	609	1063	135	36	23.49	1078.1	979.8
2	AP1	2910	528	1218	120	50	23.58	568.6	595.4
3	BP4	3407	642	988	146	-8	23.71	843.1	802.5
4	RP1	4098	491	1235	78	27	23.69	348.0	428.9
5	BP1	3400	456	1305	90	22	23.55	534.0	569.3
6	SR2A	3212	463	1288	90	39	23.42	525.8	476.4
7	BP2	3376	-557	1099	270	0	23.70	583.8	606.9
8	URBP	3406	-367	1366	270	35	23.64	545.8	578.2
9	RP2	4257	-519	1149	295	10	23.51	310.5	400.7
10	AP3	2542	-607	1063	225	36	23.69	984.6	909.3

Note : Origin of coordinate system is the front center of the vehicle bumper using Saturn's reference coordinate (front outboard seatbolt hole : x=3263.8mm , y=-753.3mm , z=593.9mm)

*HIC(d)=0.75446(Free Motion Headform HIC)+166.4

DATA SHEET 2-2

TEST RESULTS SUMMARY TABLE

Year/Make/Model/Body Style: 2003 Saturn Ion 4-door Sedan

Vehicle Body Color: Silver VIN: 1G8AF52F03Z138200

Vehicle NCSA No.: C39112 Month & Year of Manufacture: 01/03

	Target (mm)			Horizontal Impact angle	Vertical Impact Angle	Velocity (KPH)	PMU-DIC	DICId
	X	Y	Z					
A-PILLAR DRIVER SIDE								
AP1	2906	-528	1219	-	-	-	-	-
AP2	2668	-577	1129		-	-	-	-
AP3	2542	-607	1063	225	36	23.09	984.6	909.7
A-PILLAR PASSENGER SIDE								
AP1	2910	528	1218	120	50	23.48	568.6	595.4
AP2	2669	579	1129	-	-	-	-	-
AP3	2543	609	1063	135	36	25.49	1078.1	979.8
B-PILLAR DRIVER SIDE								
BP1	3403	-453	1303			-	-	-
BP2	3376	-537	1099	270	0	23.70	583.8	606.9
BP3	3331	-601	1095	R=2		-	-	-
REL. BP3	3362	-560	1089	-	-	-		
BP4	3411	-636	982	-	-	-	-	-
B-PILLAR PASSENGER SIDE								
BP1	3400	456	1305	90	22	23.55	534.0	569.3
BP2	3373	551	1064	-	-	-	-	-
BP3	3337	597	1095	R=2		-	-	-
REL. BP3	3350	577	1055	-	-	-	-	-
BP4	3407	642	988	146	8	23.71	843.1	802.5
FRONT HEADER DRIVER SIDE								
FH1	2816	-428	1266	R=2		-	-	-
REL. FH1	2808	-389	1268	-	-	-		-
FH2	2794	-274	1275	-	-	-	-	-
FRONT HEADER PASSENGER SIDE								
FH1	2817	422	1266	R=2		-	-	-
REL. FH1	2854	396	1241	-	-	-	-	-
FH2	2795	279	1271	-	-	-	-	-

Note R=1 - Relocated once (one sphere) R=2 - Relocated twice (two spheres)

	Target (mm)			Horizontal Impact angle	Vertical Impact Angle	Velocity (KPH)	FMH-HIC	HIC(d)
	X	Y	Z					
REAR HEADER DRIVER SIDE								
RH	4149	-329	1286	-	-	-	-	-
REAR HEADER PASSENGER SIDE								
RH	4152	335	1287	-	-	-	-	-
SIDE RAIL DRIVER SIDE								
SR1	3061	-466	1279	-	-	-	-	-
SR2A	3211	-480	1279	-	-	-	-	-
SR2B	3103	-462	1285	-	-	-	-	-
SR3	3553	-483	1287	-	-	-	-	-
SIDE RAIL PASSENGER SIDE								
SR1	3062	468	1275	-	-	-	-	-
SR2A	3212	463	1288	90	39	23.42	525.8	476.4
SR2B	3103	466	1279	-	-	-	-	-
SR3	3554	481	1284	-	-	-	-	-
UPPER ROOF DRIVER SIDE								
URBP	3406	-367	1366	270	35	23.64	545.8	578.2
UPPER ROOF PASSENGER SIDE								
URBP	3404	366	1367	-	-	-	-	-
REAR PILLAR DRIVER SIDE								
RP1	4089	-483	1239	-	-	-	-	-
RP2	4280	-594	1091	R=4		-	-	-
REL. RP2	4257	-519	1149	295	10	23.51	310.5	400.7
REAR PILLAR PASSENGER SIDE								
RP1	4098	491	1235	78	27	23.69	348.0	428.9
RP2	4290	592	1084	R=4		-	-	-
REL. RP2	4262	523	1150	-	-	-	-	-

Note R=1 - Relocated once (one sphere) R=2 - Relocated twice (two spheres)

DATA SHEET 2-3

GENERAL TEST AND VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2003 Saturn Ion 4-door Sedan

Vehicle Body Color: Silver VIN: 1G8AF52F03Z138200

Vehicle NHTSA No.: C30112 Month & Year of Manufacture: 01/03

Engine Data: 4 Cylinders; - CID; 2.2 Liters; - cc

Engine Placement: - Longitudinal: or x Lateral

Transmission: 5 Speed: x Manual: - Automatic; - Overdrive

Final Drive: x Rear Wheel Drive; - Front Wheel Drive; - Four Wheel

Odometer Reading 116 km

Options: - A/C; x Power Steering; x Pwr.Brakes; x Pwr. Windows

Interior Trim Information :

1. Both B-pillars contain seat belt anchorages.

DATA FROM TIRE PLACARD

Tire Pressure (at capacity); 210 kPa FRONT

210 kPa REAR

Recommended Tire Size: P185/70R14

Tires on Test Vehicle: P185/70R14 ; Manufacturer: Firestone

Vehicle Capacity Data:

Number of Occupants: 2 Front; 3 Rear; - 3rd Seat; 5 Total

Type of Front Seats: x Bucket; - Bench; - Split Bench

Type of Front Seat Back: - Fixed; x Adjustable with x Lever or - Knob

Vehicle Capacity Weight (VCW)= 408 kg (A)

No. of Occupants x 68 kg. – 340 kg (B)

Rated Cargo/Luggage Weight (RCLW) = 68 kg (A-B) Max. RCLW = 136 kg.

TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:

Left Front	=	362.5 kg	Left Rear	=	248.0 kg
Right Front	=	360.0 kg	Right Rear	=	248.5 kg
TOTAL FRONT	=	722.5 kg	TOTAL REAR	=	496.5 kg
% of Total Weight	=	59.3 %	% of Total Weight	=	40.7 %
TOTAL WEIGHT	=	1219.0 kg			

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Test Vehicle Delivered Weight = 1219.0 kg

Rated Cargo/Luggage Weight = 68.0 kg

TEST VEHICLE TARGET WEIGHT: = 1287.0 kg

WEIGHT OF TEST VEHICLE (FULLY LOADED):

Left Front		362.0	kg	Left Rear		278.0	kg
Right Front	=	362.0	kg	Right Rear	=	278.0	kg
TOTAL FRONT	=	724.0	kg	TOTAL REAR	=	556.0	kg
% of Total Weight	=	56.6	%	% of Total Weight	=	43.4	%

TOTAL TEST WEIGHT = 1280.0 kg

Weight of vehicle secured in test vehicle's cargo area = 68 kg.

TEST VEHICLE ATTITUDE (all dimensions in millimeters):

AS DELIVERED:

Left Front 725 Right Front 725 Left Rear 713 Right Rear 714

FULLY LOADED:

Left Front 725 Right Front 725 Left Rear 702 Right Rear 703

Test Vehicle Wheelbase: 2620 millimeters

TEST VEHICLE PITCH AND ROLL ANGLES:

AS DELIVERED:

PITCH ANGLES			ROLL ANGLES		
Left Door Sill	0.1 °	Right Door Sill 0.1 °	Front Bumper	0.1 °	Rear Bumper 0.0 °

FULLY LOADED:

PITCH ANGLES			ROLL ANGLES		
Left Door Sill	0.4 °	Right Door Sill 0.4 °	Front Bumper	0.1 °	Rear Bumper 0.1 °

AS TESTED:

PITCH ANGLES			ROLL ANGLES		
Left Door Sill	0.1 °	Right Door Sill 0.1 °	Front Bumper	0.1 °	Rear Bumper 0.0 °

DATA SHEET 2-4
TARGET MEASUREMENT REFERENCE SHEET

Year/Make/Model/Body Style: 2003 Saturn Ion 4-door Sedan
Vehicle Body Color: Silver VIN: 1G8AF52F03Z138200
Vehicle NHTSA No.: C30112 Month & Year of Manufacture: 01/03

Measurements	Description	Left Side	Right Side
M	Seat fore / Aft travel (Front seats)	260	260
T°	Horizontal angle {CG-F1 (Left seat) to (Right A-pillar)}	112	-
A1°	360° - T°	248	-
W°	Horizontal angle {CG-F2 (Left seat) to (Left A-pillar)}	201	-
A2°	A2° – W°	201	-
U°	Horizontal angle {CG-F2 (Left seat) to (Left B-pillar)}	284	-
B1°	B1° = U°	284	-
V°	Horizontal angle {CG-FR (Left seat) to (Right B-pillar)}	202	-
B2°	B2° = V°	202	-
W°	Horizontal angle {CG-F2 (Right seat) to (Right A-pillar)}	-	159
A1°	A1° (Right) – W° (Right)	-	159
T°	Horizontal angle {CG-F1 (Right seat) to (Left A-pillar)}	-	248
A2°	360° - T°(Right)	-	112
V°	Horizontal angle {CG-FR (Right seat) to (Right B-pillar)}	-	158
B1°	B1° (Right) = V° (Right)	-	158
U°	Horizontal angle {CG-F2 (Right seat) to (Right B-pillar)}	-	73
B2°	B2° (Right) – U° (Right)	-	73
J	A-pillar {(Plane 3) - (Plane 5)}	308	306
J/2	J÷2	154	153
D1	Upper Roof {(Plane A) - (Plane B)}	1520	
D1/2	D1÷2	760	
D2	Upper Roof {(Plane C) - (Plane D)}	1172	
D2/2	D2÷2	586	
.35D1	.35 x D1	532	
.35D2	.35 x D2	410	
N	B-pillar {(BP8) - (lowest point on the daylight opening forward of B-pillar)}	422	422
N/2	B-pillar {(BP3) - (lowest point on the daylight opening forward of B-pillar)}	211	211

Measurement	Description	Left Side	Right Side
N/4	B-pillar {(BP3) - (lowest point on the daylight opening forward of B-pillar)}	105.5	105.5
Q	Other-pillar {(OPR) - (lowest point on the daylight opening forward of O-pillar)}	-	-
Q/2	Other-pillar {(OP2) - (lowest point on the daylight opening forward of O pillar)}	-	-
D	{(Corner of roof area, point 7) - (roof area center, point M)}	685	686
3D/7	(3 x D) ÷7	294	294
MM	Widest door opening of slider door	-	-
M	MM ÷ 2	-	-

DATA SHEET 2-5

APPROACH ANGLE LIMITS

Left Side					Right Side				
Target Code	Horizontal Angles (deg.)		Vertical Angles (deg.)		Target Code	Horizontal Angles (deg.)		Vertical Angles (deg.)	
	Minimum	Maximum	Minimum	Maximum		Minimum	Maximum	Minimum	Maximum
AP1	201	248	-5	50	AP1	112	159	-5	50
AP2	201	248	-5	49	AP2	112	159	-5	45
AP3	201	248	-5	36	AP3	112	159	-5	36
BP1	202	284	-10	23	BP1	73	158	-10	22
BP2	ANY		0	0	BP2	ANY		0	3
BP3	202	284	-10	10	BP3	73	158	-10	4
BP4	202	284	-10	-8	BP4	73	158	-10	-8
OP1	270		-10	-	OP1	90		-10	-
OP2	270		-10	-	OP2	90		-10	-
RP1	270	345	-10	26	RP1	15	90	10	27
RP2	270	345	-10	10	RP2	15	90	-10	10
FH1	180		0	50	FH1	180		0	50
FH2	180		0	50	FH2	180		0	50
RH	360		0	50	RH	0		0	50
SR1	270		0	35	SR1	90		0	37
SR2A	270		0	48	SR2A	90		0	40
SR2B	270		0	38	SR2B	90		0	38
SR3	270		0	47	SR3	90		0	48
SD	270		0	-	SD	90		0	-
URBP	ANY		0	35	URBP	ANY		0	34

Note : BP2 target location - Seat belt anchorage

DATA SHEET 2-6

POST-TEST VISUAL INSPECTION

Year/Make/Model/Body Style:	2003 Saturn Ion 4-door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

REMARKS:

1. BP2 seat belt anchorage broke into pieces after impact

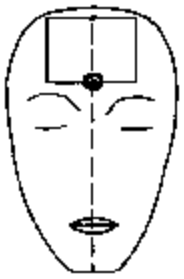
DATA SHEET 2-7

TARGET IMPACT LOCATION ON FMH SUMMARY

Year/Make/Model/Body Style: 2003 Saturn Ion 4-door Sedan

Vehicle Body Color: Silver VIN: 1G8AF52F03Z138200

Vehicle NHTSA No.: C30112 Month & Year of Manufacture: 01/03



← RIGHT SIDE OF FACE

TARGET	Distance Above Pt. O (mm)	Distance Over From Pt. O (mm)
AP4	24	0
AP1	27	12 to the right
BP4	32	10 to the left
RP1	24	0
BP1	43	4 to the right
SR2A	21	0
BP2	0	6 to the left
URBP	39	6 to the left
RP2	42	5 to the right
AP3	29	0

SECTION 3

SUMMARY OF TEST RESULTS AND DATA PLOTS

TEST SUMMARY SHEET FOR FMVSS 201/U TESTING

Year/Make/Model/Body Style: 2003 Saturn Ion 4-door Sedan

Vehicle Body Color: Silver VIN: 1G8AF52F03Z138200

Vehicle NHTSA No.: C30112 Month & Year of Manufacture: 01/03

Test Number: 1 Test Date: MAY 12, 2003

Target Location: A-PILLAR Target Code. AP3

Horizontal Impact Angle: 135 ° Vertical Impact Angle: 36 °

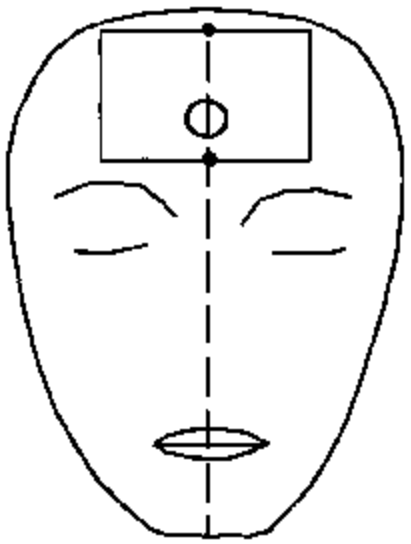
Ambient Temperature: 22 °C Time of Impact: 10:30

Headform Number: 0062

Impact Point:

Description:

Description:	From lower midpoint				
On centerline	24	mm up			
On centerline	0	-	mm right	-	mm left



Free Motion HIC: 1078 1 HIC(d): 979 8

Impact Velocity (kph): 23.49 HICT1 3.2 msec HICT2 8.3 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112 - AP3

FMH Headform 0062

Test Date: May 12, 2003

Location: AP3

Work File: AP3

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 32 %

Velocity at Impact: 23.49 KPH

Free Flight Distance: 213.64 mm

HICd: 979.8

HIC (36ms): 1078.1

t1: 3.2 msec

t2: 8.3 msec

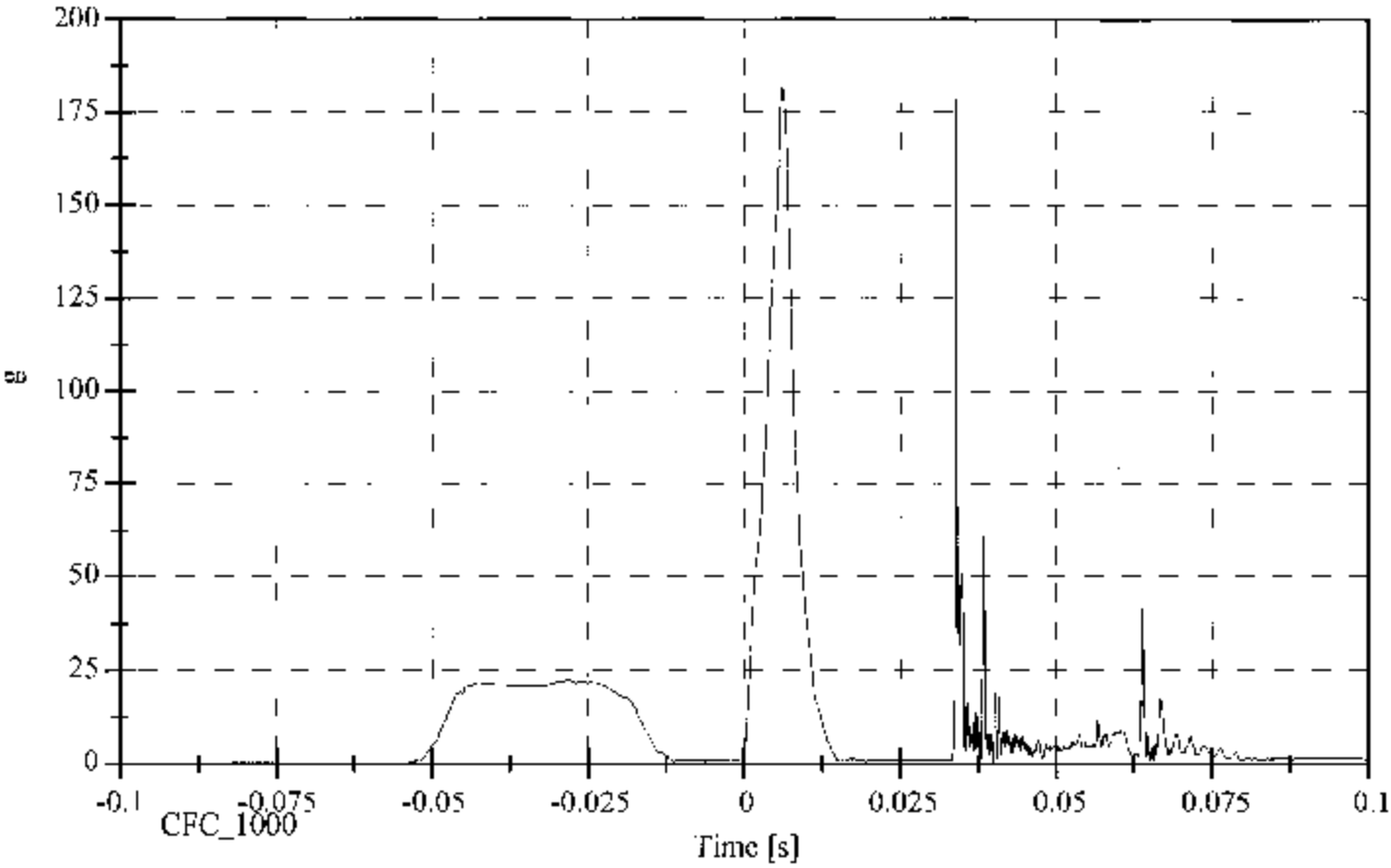
Duration: 5.1 msec

Average Acceleration: 10.5 g

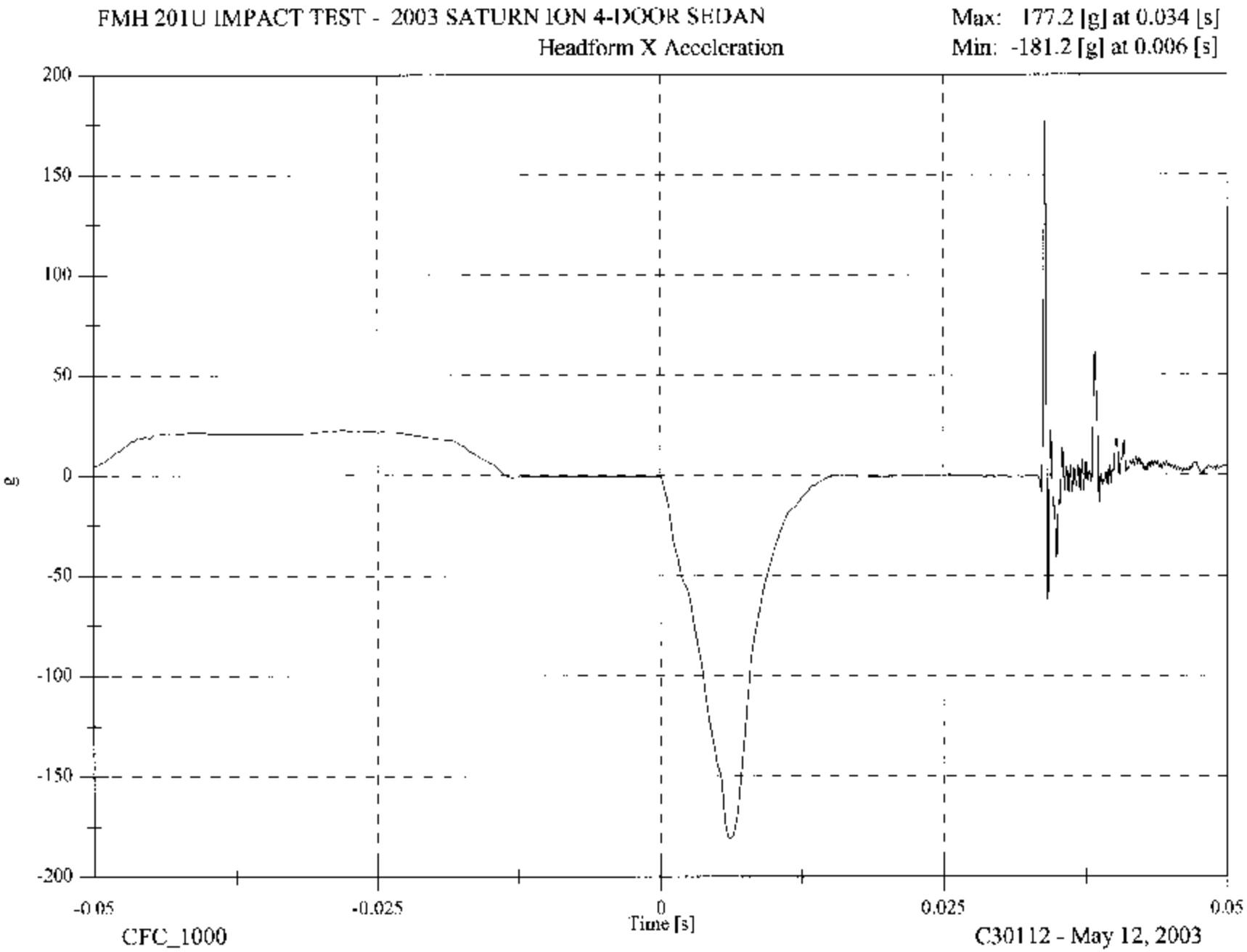
FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Resultant

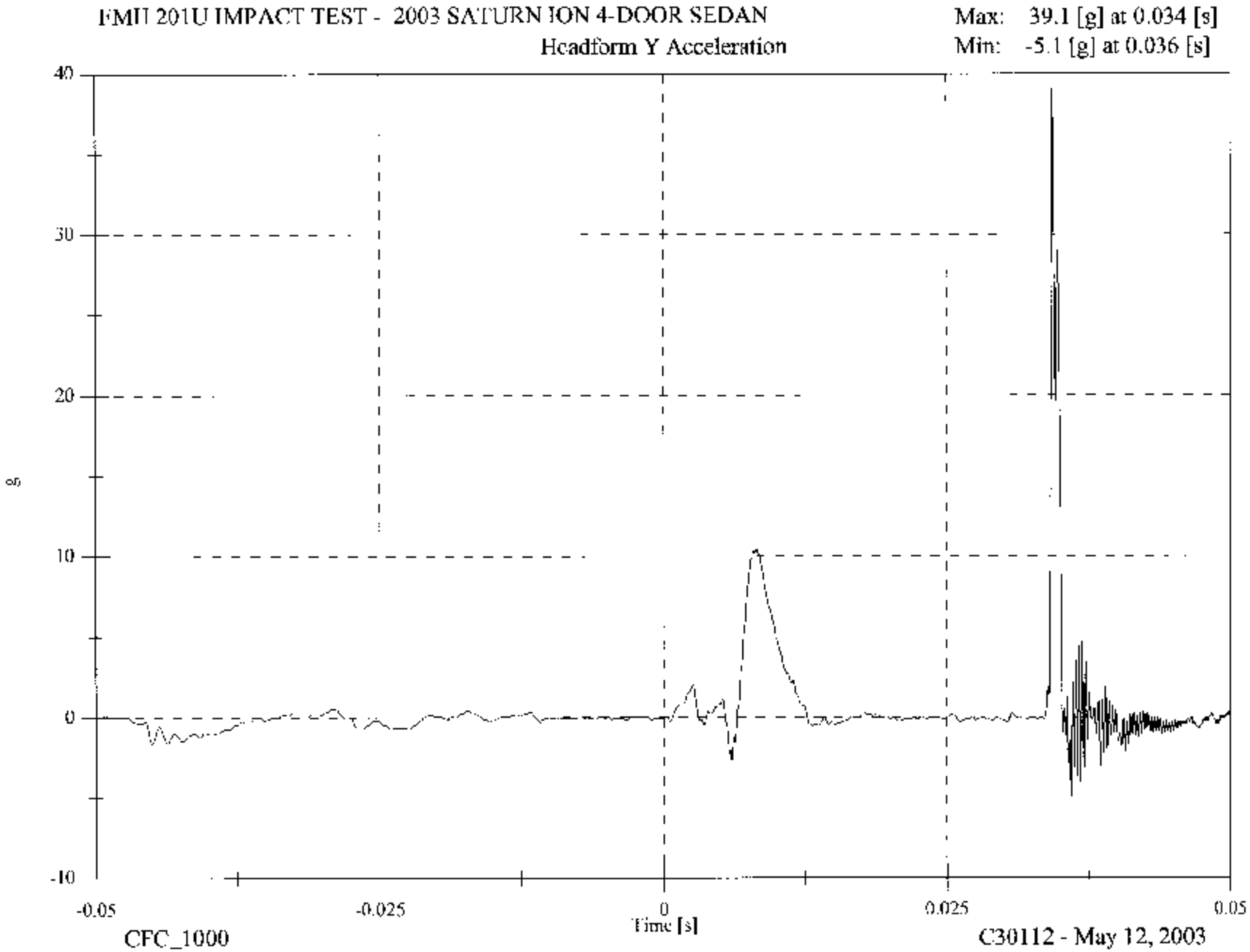
Max: 181.6 [g] at 0.006 [s]

Min: 0.0 [g] at -0.061 [s]



C30112 PASSENGER SIDE AP3 IMPACT PLOT #1





C30112 PASSENGER SIDE AP3 IMPACT PLOT #2

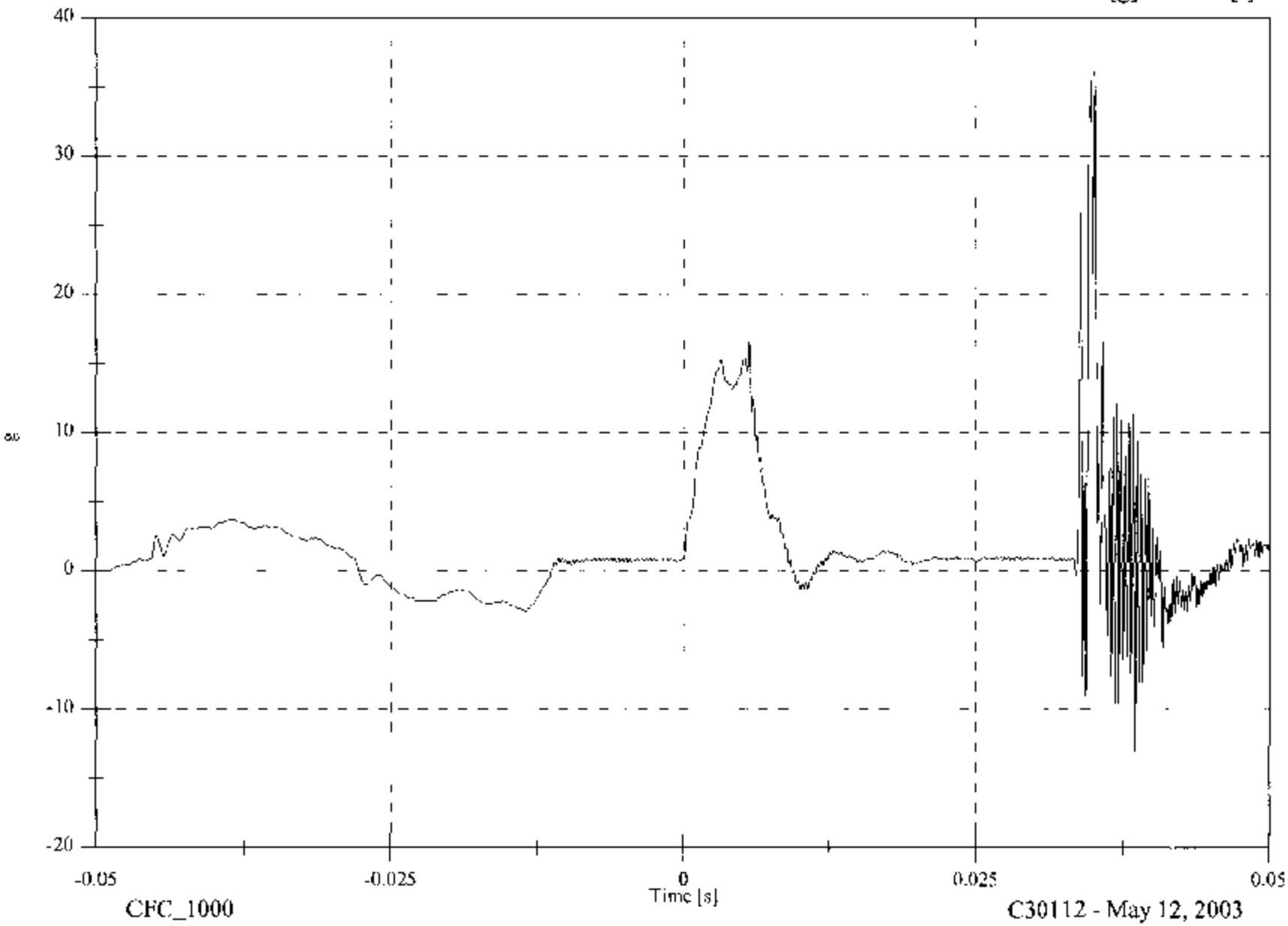
C30112 PASSENGER SIDE AP3 IMPACT PLOT #3

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Z Acceleration

Max: 36.3 [g] at 0.035 [s]

Min: -13.1 [g] at 0.039 [s]



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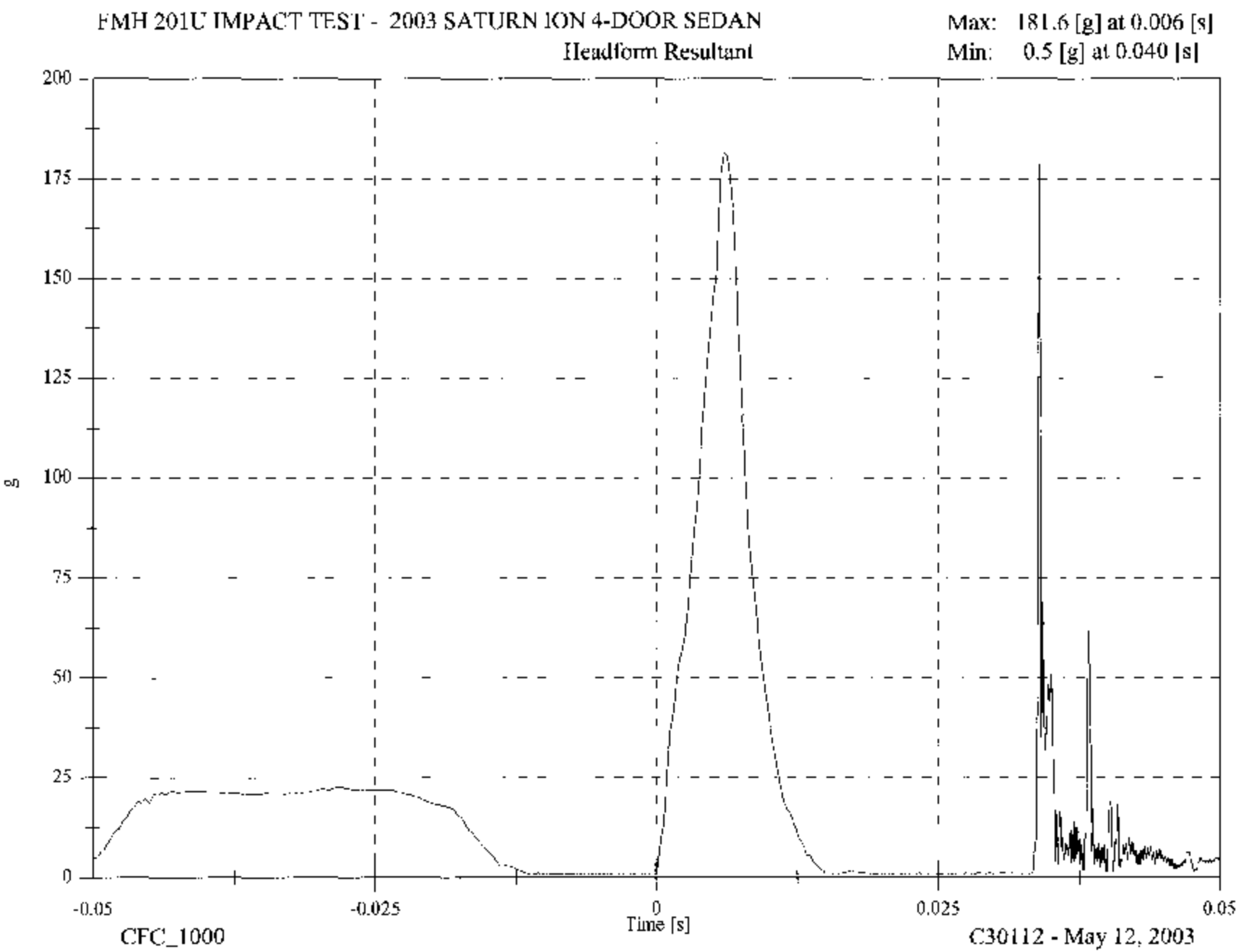
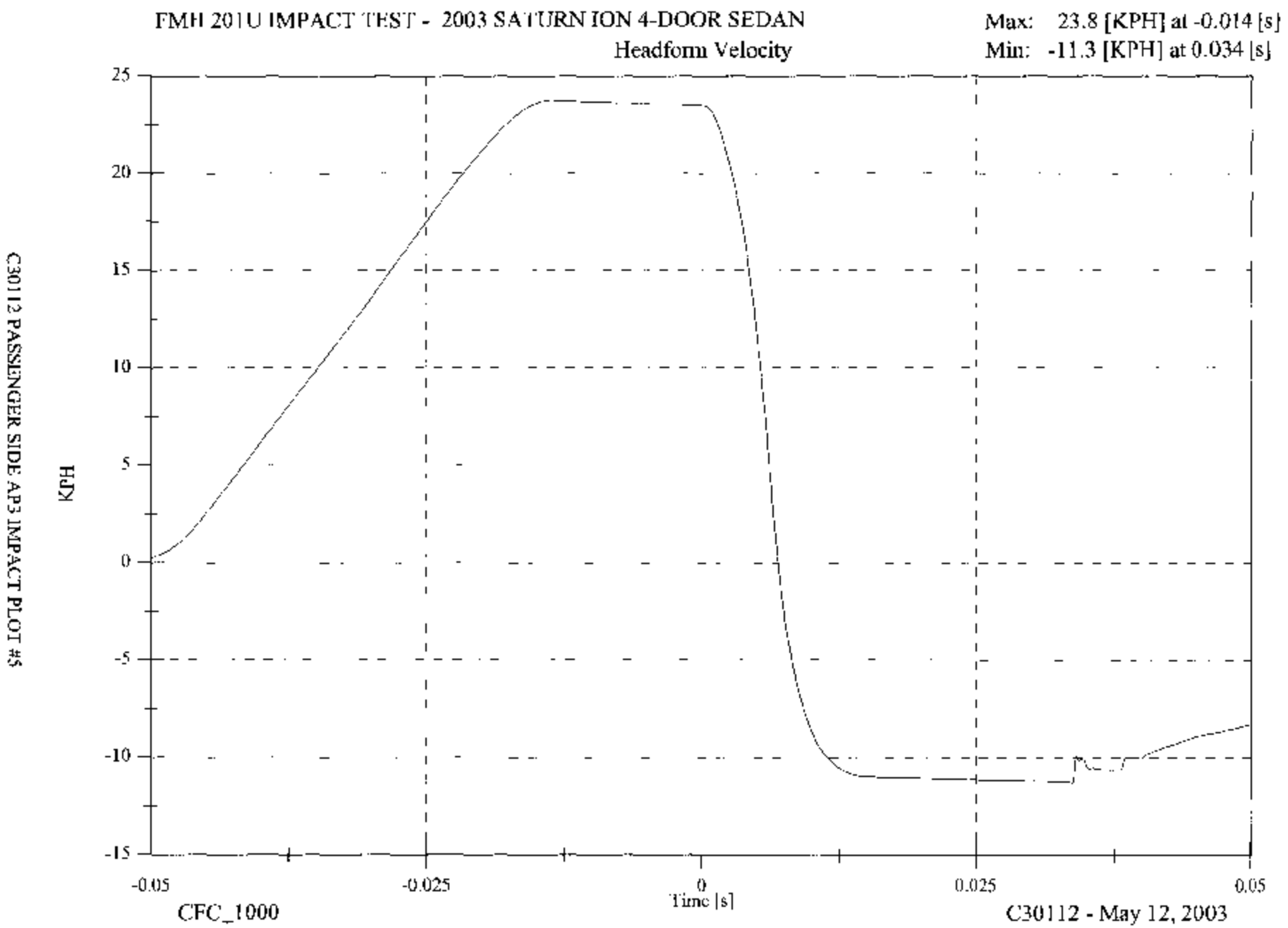
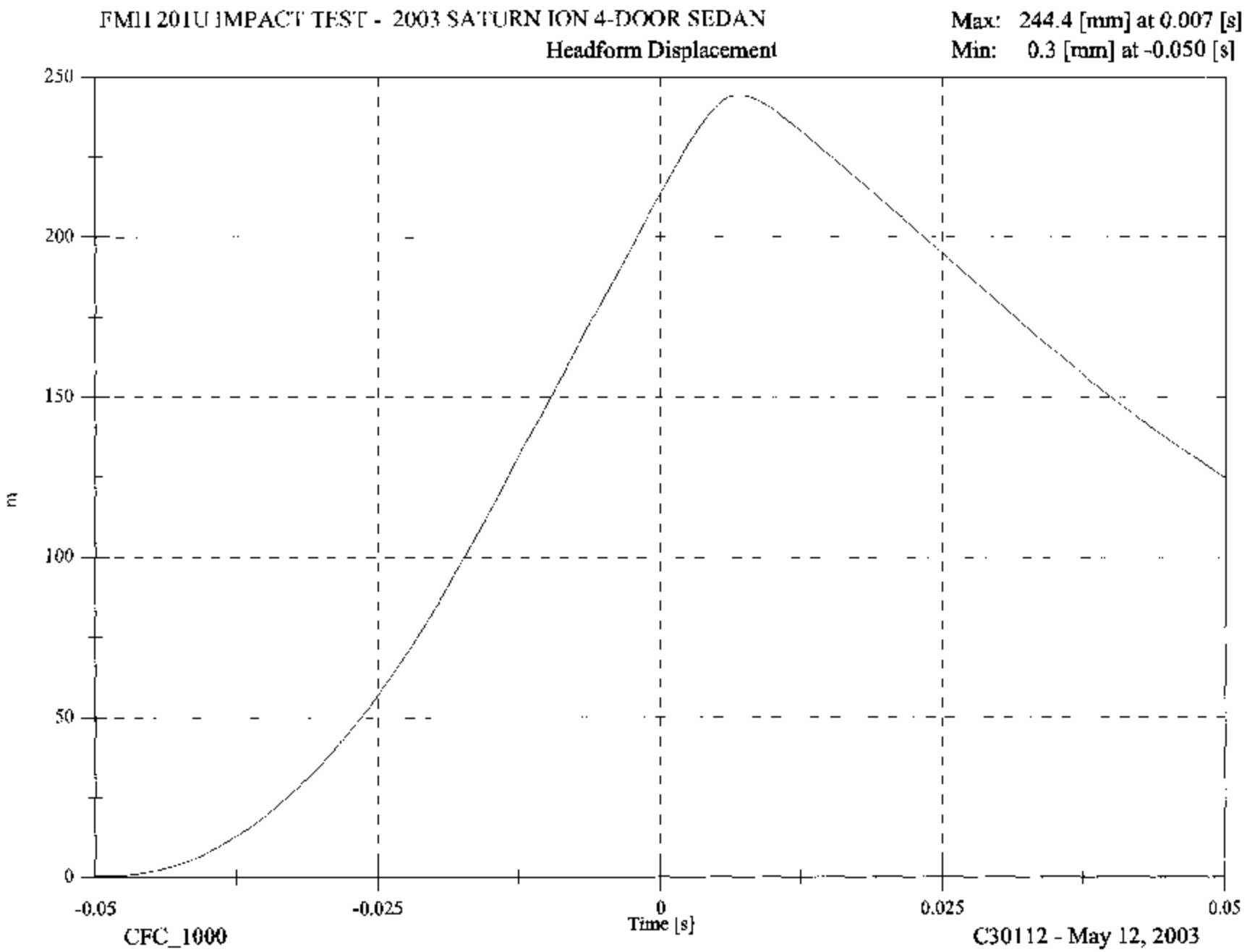
C30112 - May 12, 2003

C30112 PASSENGER SIDE AP3 IMPACT PLOT #4




FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Velocity
Max: 23.8 [KPH] at -0.014 [s]
Min: -11.3 [KPH] at 0.034 [s]
C30112 PASSENGER SIDE AP3 IMPACT PLOT #5
KPH
25
20
15
10
5
0
-5
-10
-15
-0.05
-0.025
0
0.025
0.05
Time [s]
CFC_1000
C30112 - May 12, 2003


FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Displacement
Max: 244.4 [mm] at 0.007 [s]
Min: 0.3 [mm] at -0.050 [s]
250
200
150
100
50
0
-0.05
-0.025
0
0.025
0.05
Time [s]
CFC_1000
C30112 - May 12, 2003

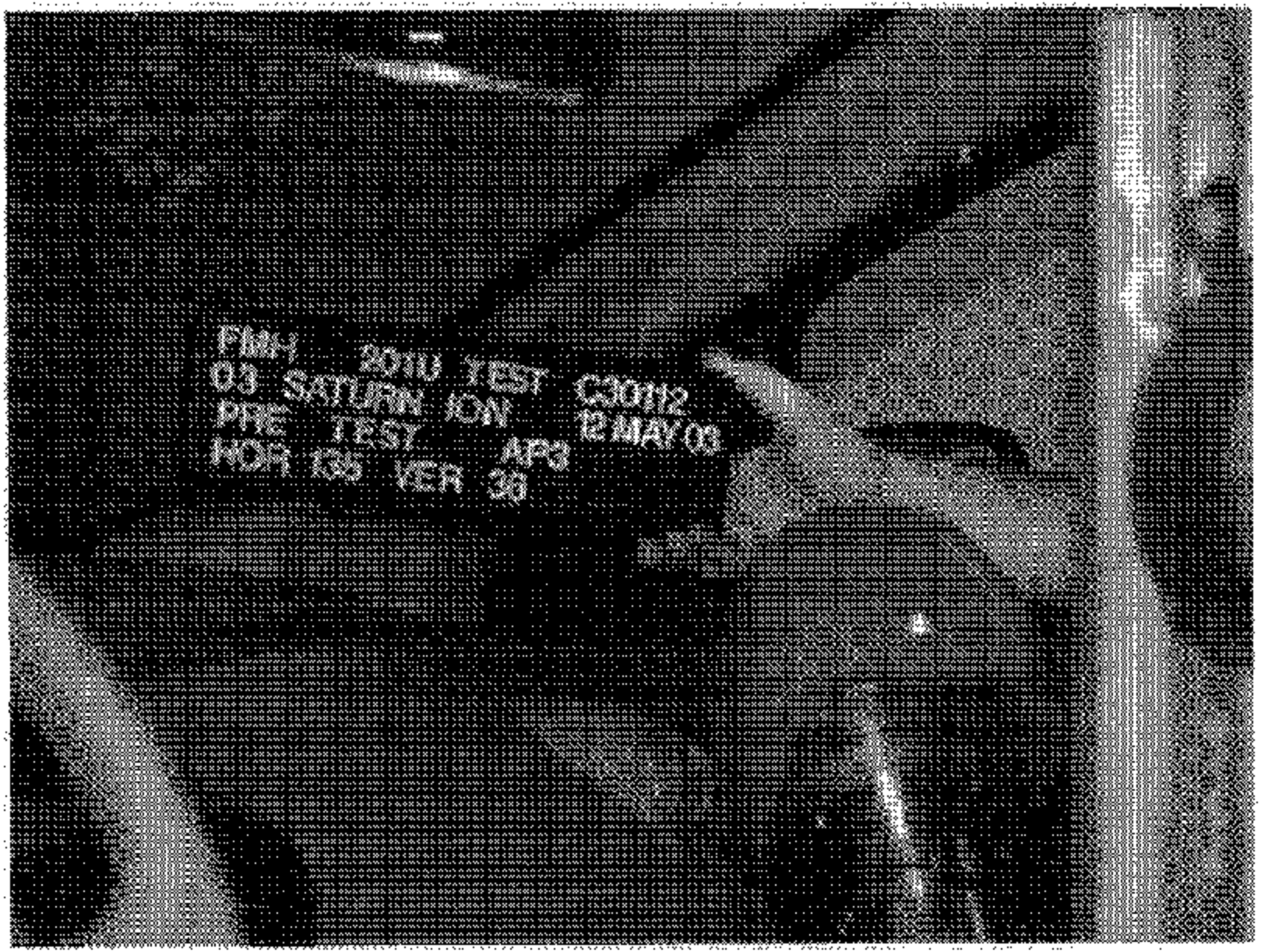


Figure : PRE-TEST AP3

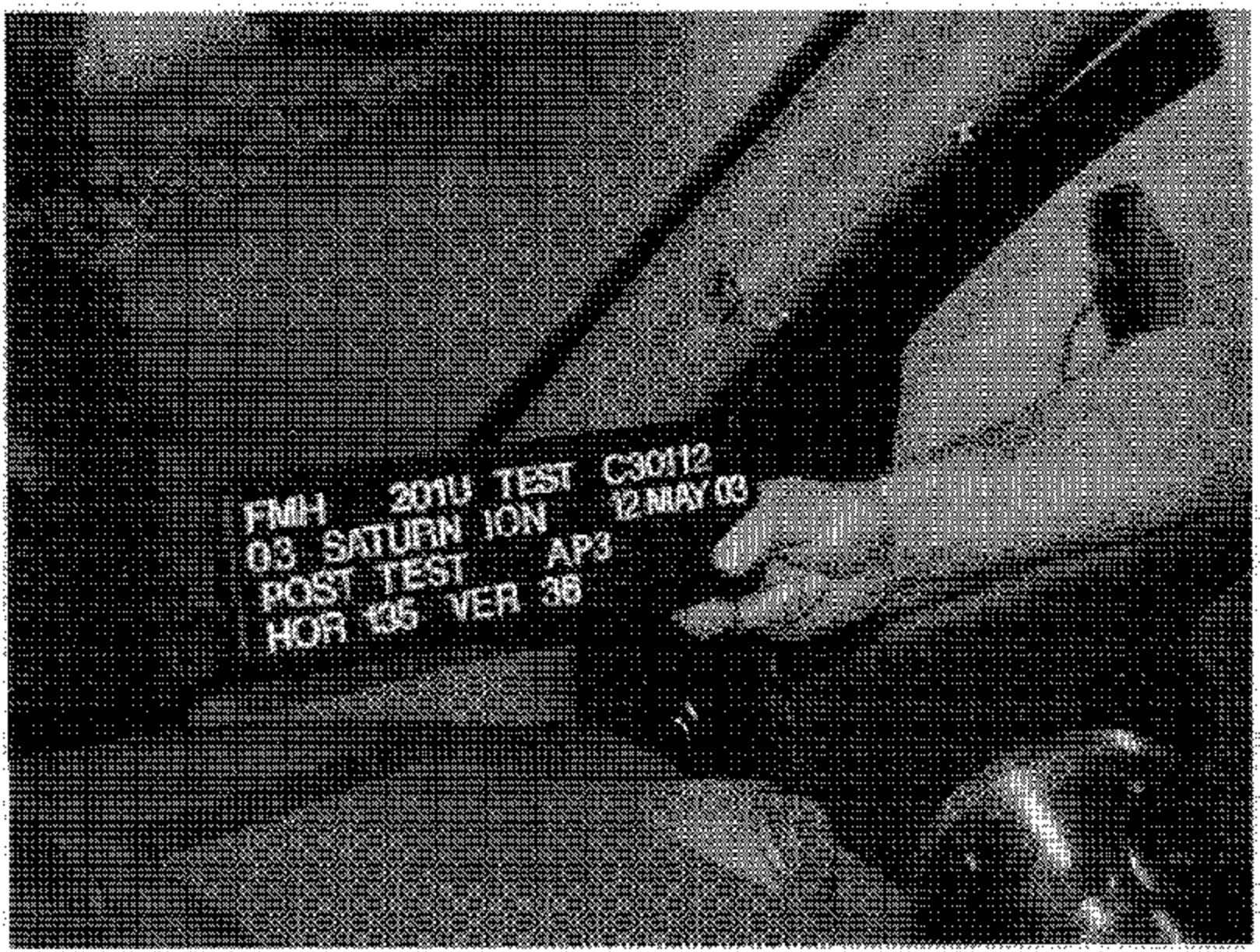


Figure : POST-TEST AP3

8953 FMH 12

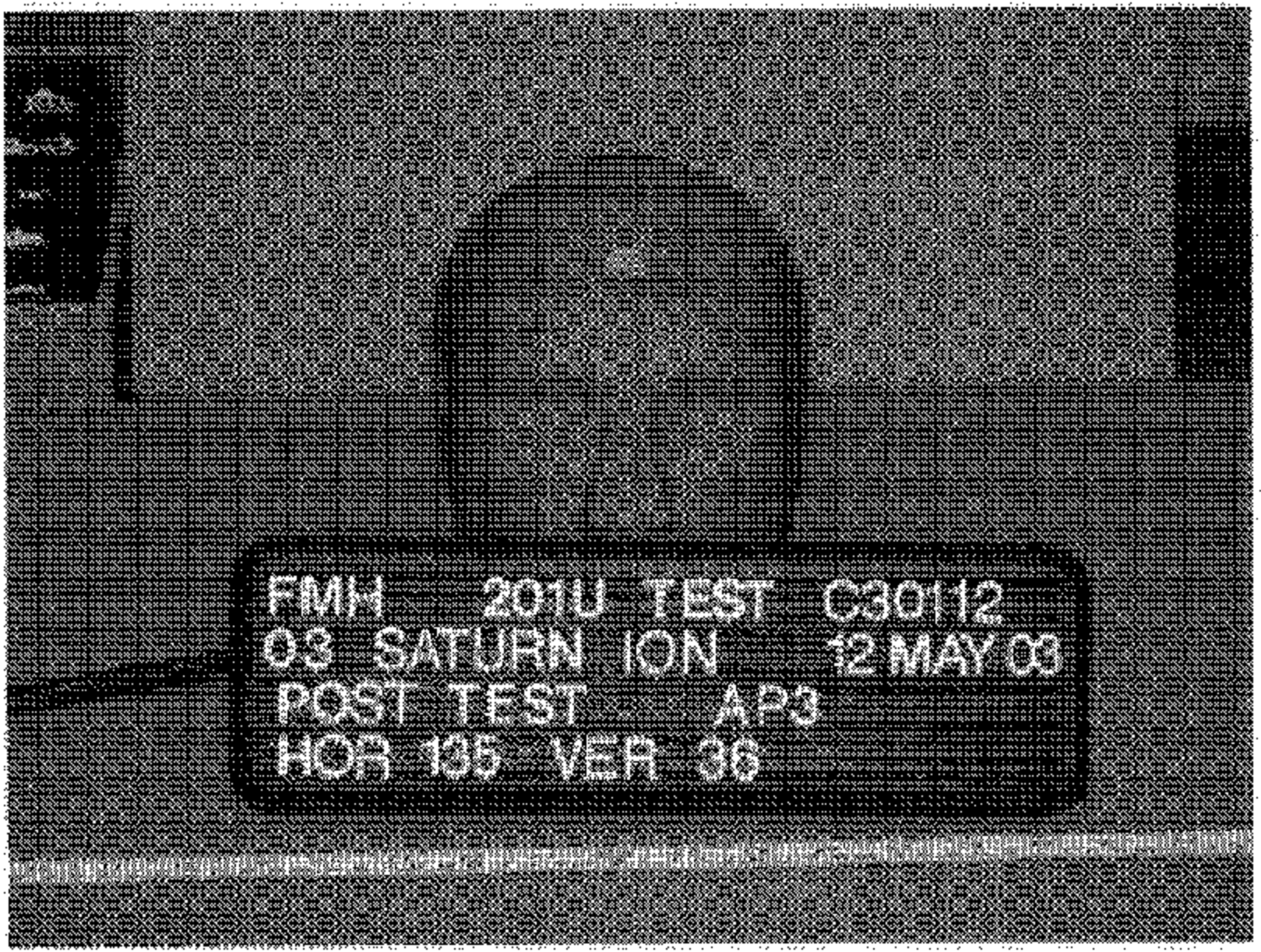


Figure : AP3 HEADFORM

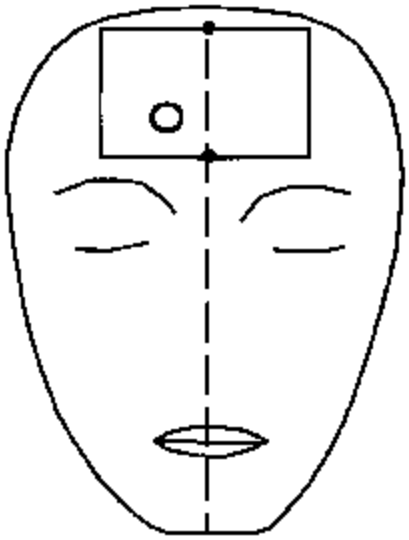
Year/Make/Model/Body Style:	2003 Saturn Ion 4-door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

Test Number:	2	Test Date:	MAY 12, 2003
Target Location:	A-PILLAR	Target Code:	AP1
Horizontal Impact Angle:	120 °	Vertical Impact Angle:	50 °
Ambient Temperature:	22 °C	Time of Impact:	11:10
Headform Number:	0642		

Impact Point:

Description:

Description:	From lower midpoint				
On centerline	27	mm up			
On centerline	12	x	mm right:	-	mm left



Free Motion HIC:	568.6	HIC(d):	595.4		
Impact Velocity (kph):	23.58	HICT1	2.5 msec	HICT2	11.1 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112 - AP1

FMH Headform 0642

Test Date: May 12, 2003

Location: AP1

Work File: AP1

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 32 %

Velocity at Impact: 23.58 KPH

Free Flight Distance: 216.40 mm

HICd: 595.4

HIC (36ms): 568.6

t1: 2.5 msec

t2: 11.1 msec

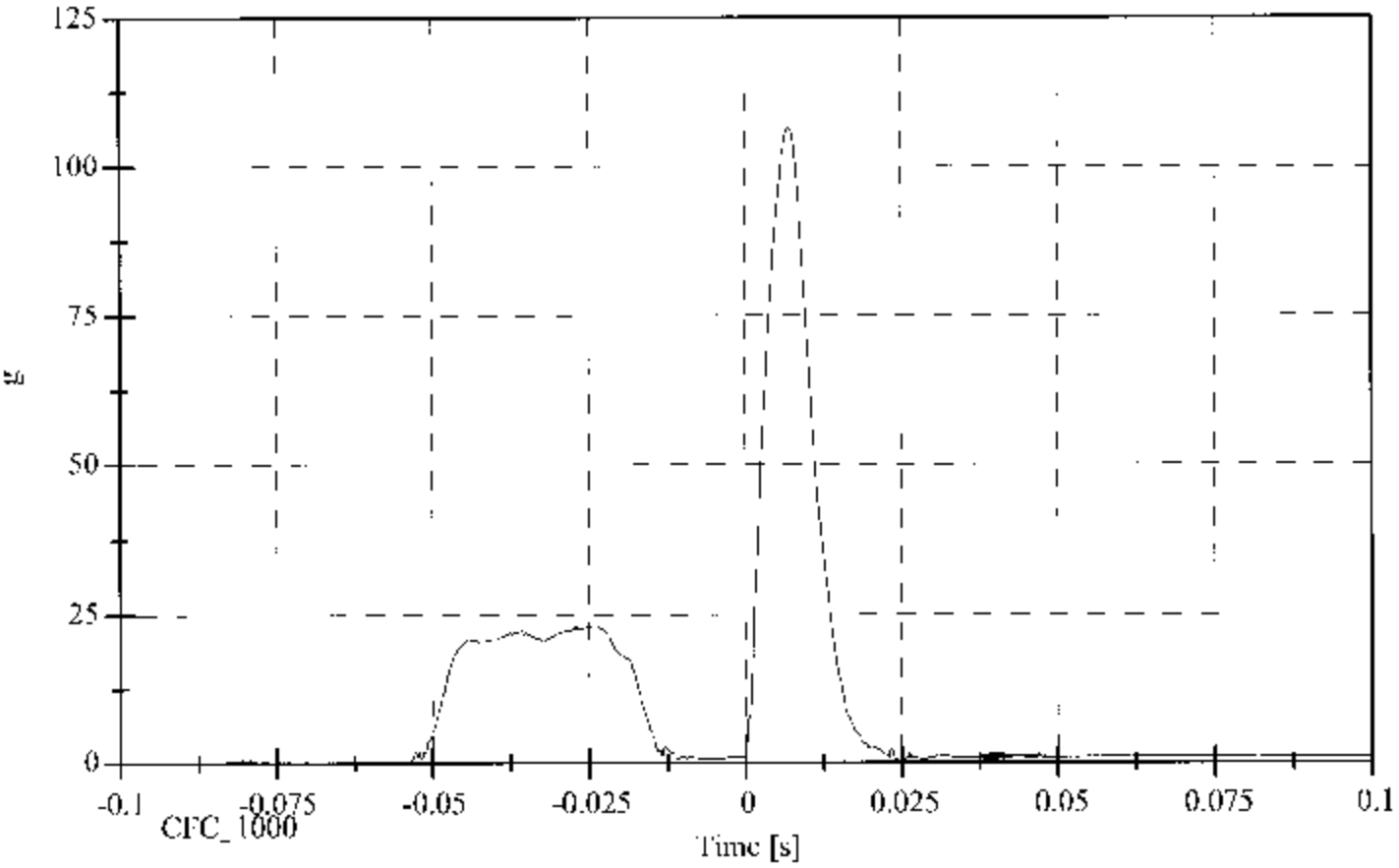
Duration: 8.6 msec

Average Acceleration: 8.6 g

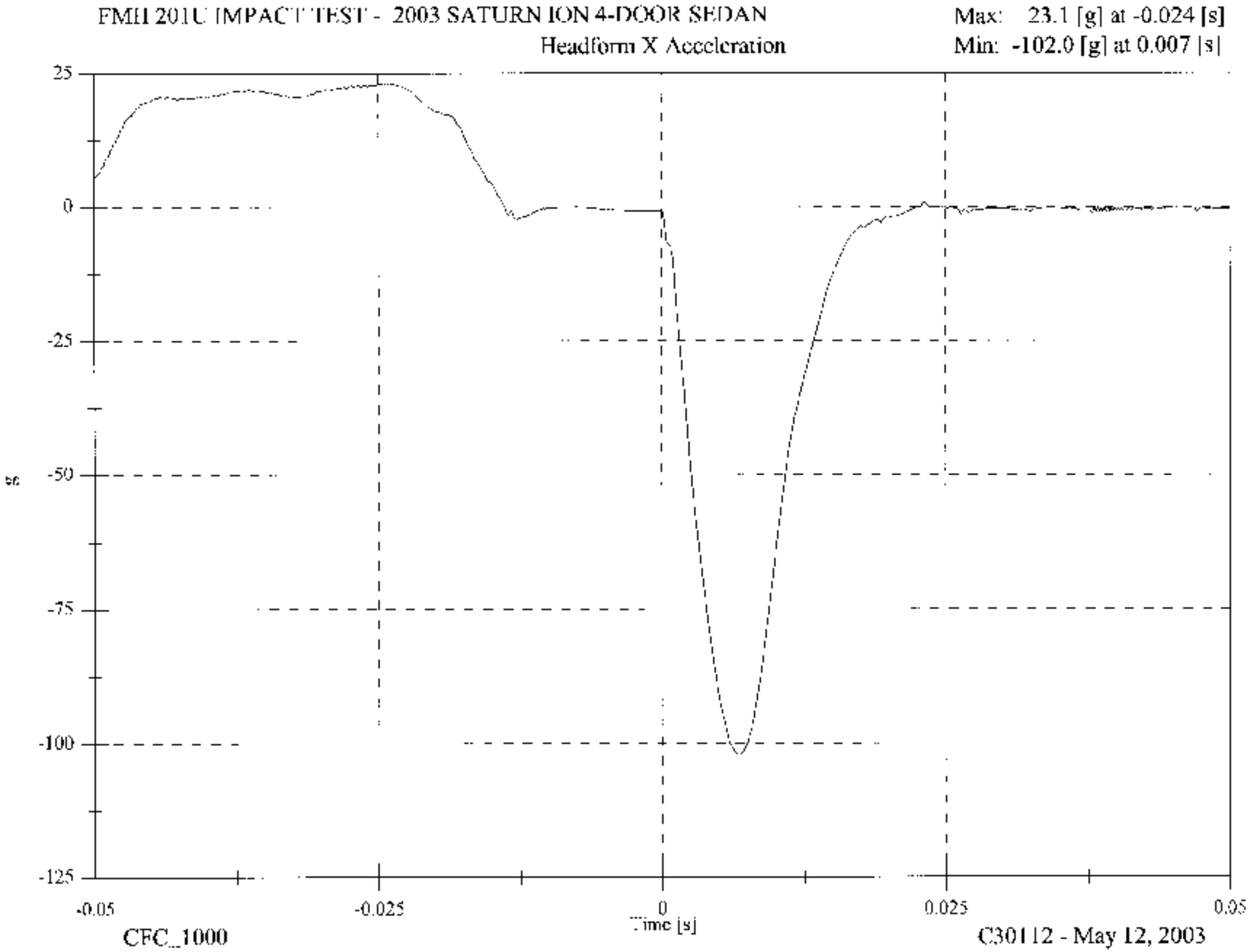
FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Resultant

Max: 106.6 [g] at 0.007 [s]

Min: 0.0 |g| at -0.067 [s]



C30112 PASSENGER SIDE API IMPACT PLOT #1



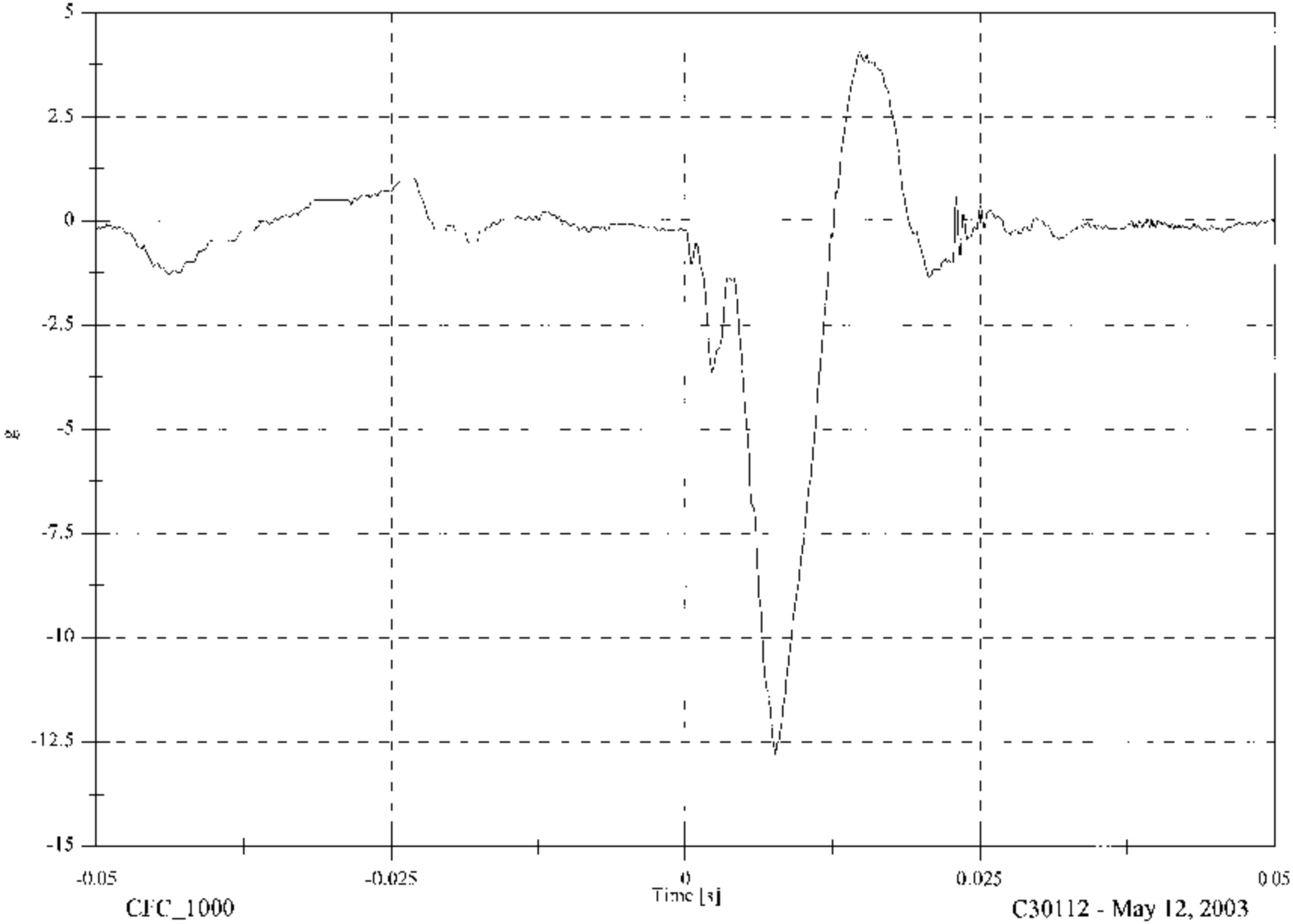
C30112 PASSENGER SIDE API IMPACT PLOT #2

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Y Acceleration

Max: 4.0 [g] at 0.015 [s]

Min: -12.8 [g] at 0.008 [s]



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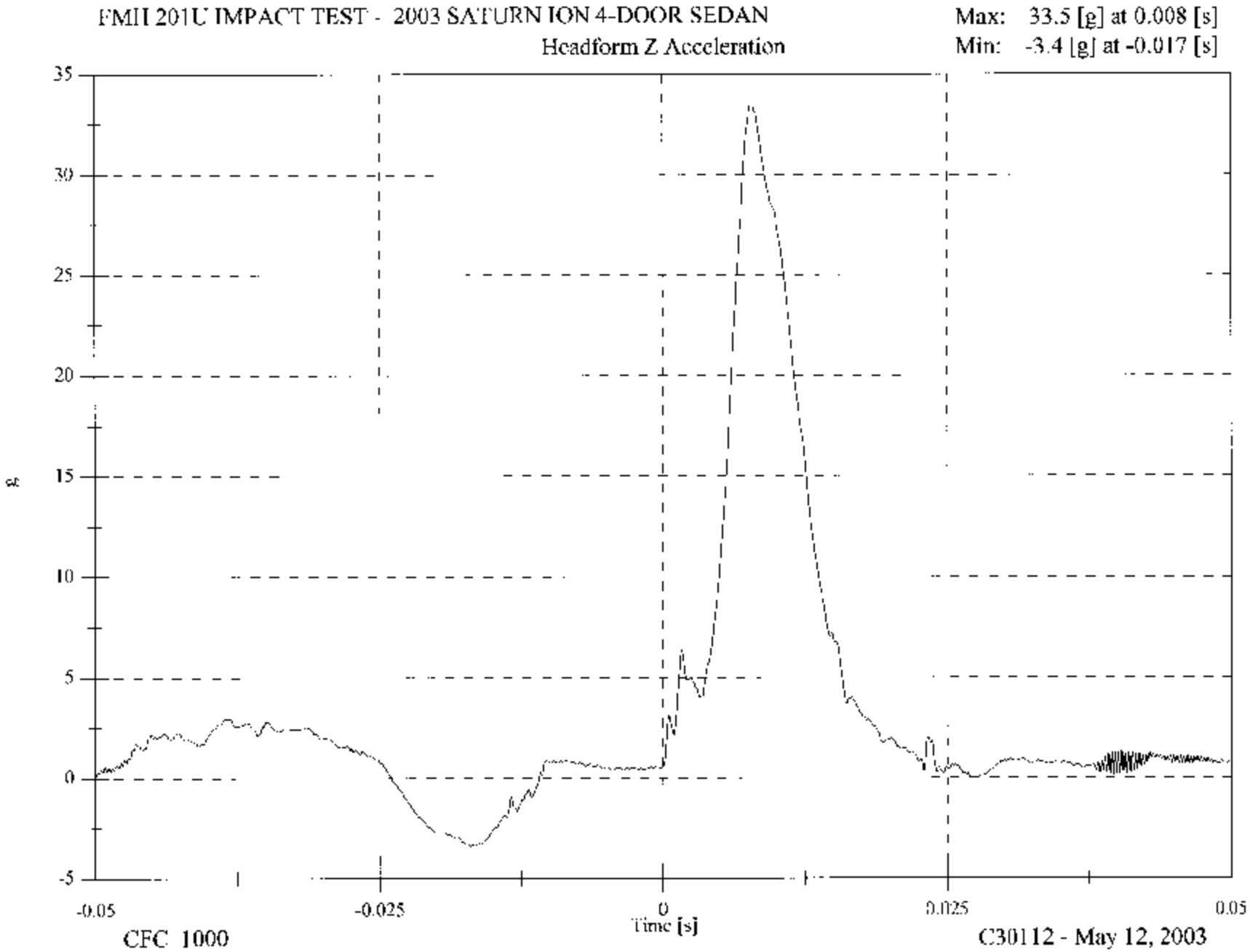
C30112 PASSENGER SIDE AP1 IMPACT PLOT #3



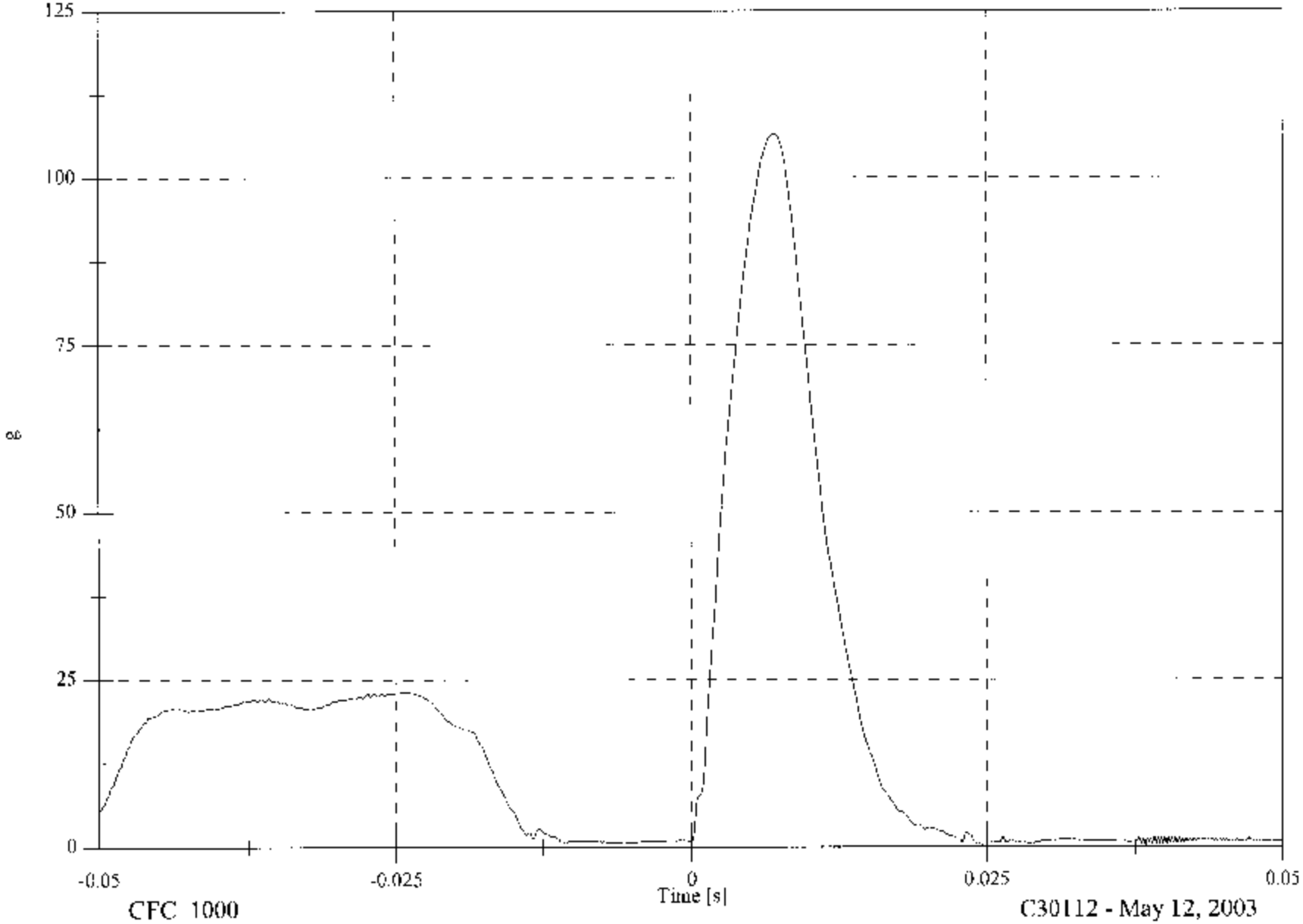
C30112 PASSENGER SIDE API IMPACT PLOT #4

FM11 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Resultant

Max: 106.6 [g] at 0.007 [s]

Min: 0.3 [g] at 0.038 [s]



CFC 1000

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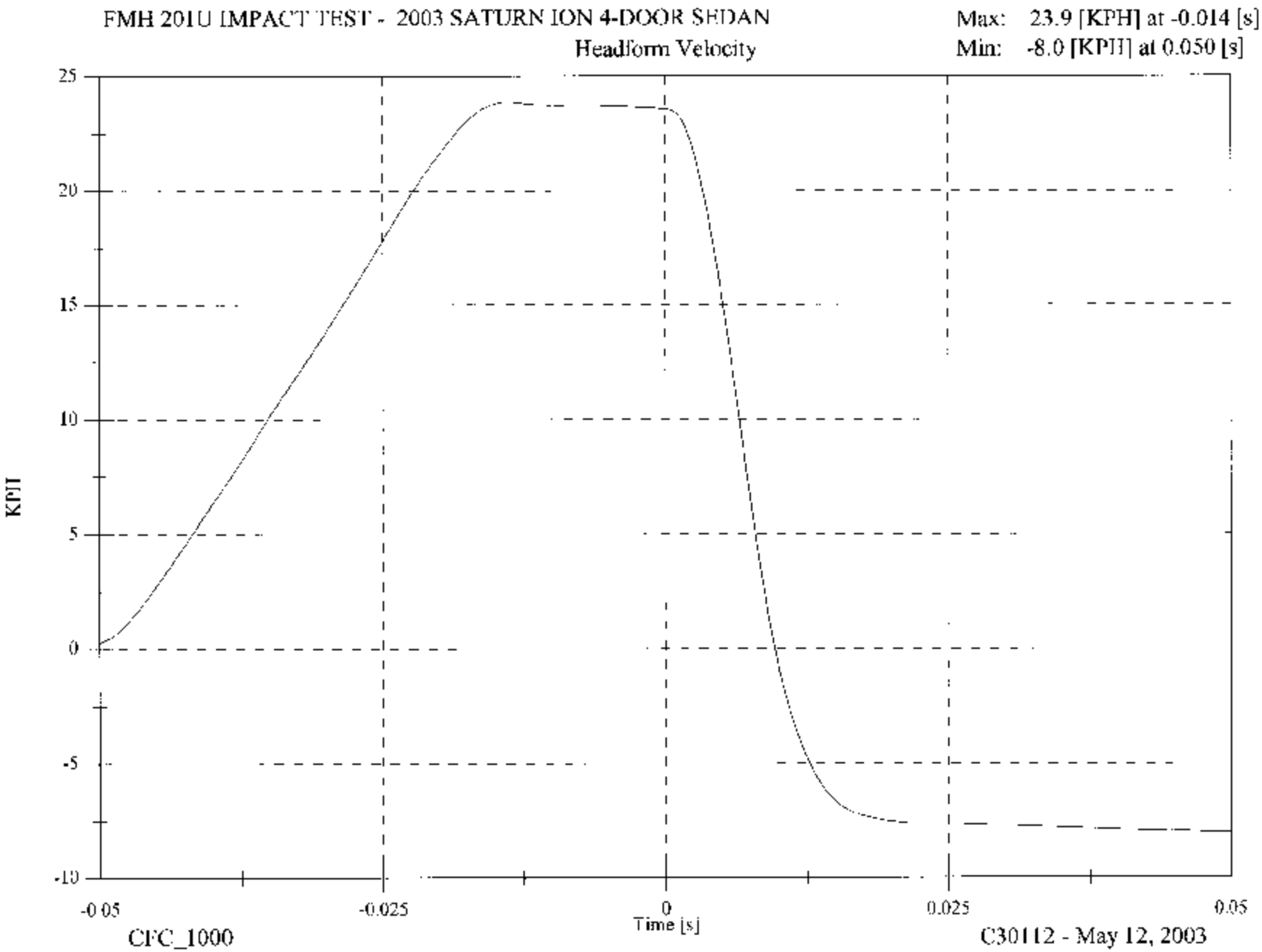
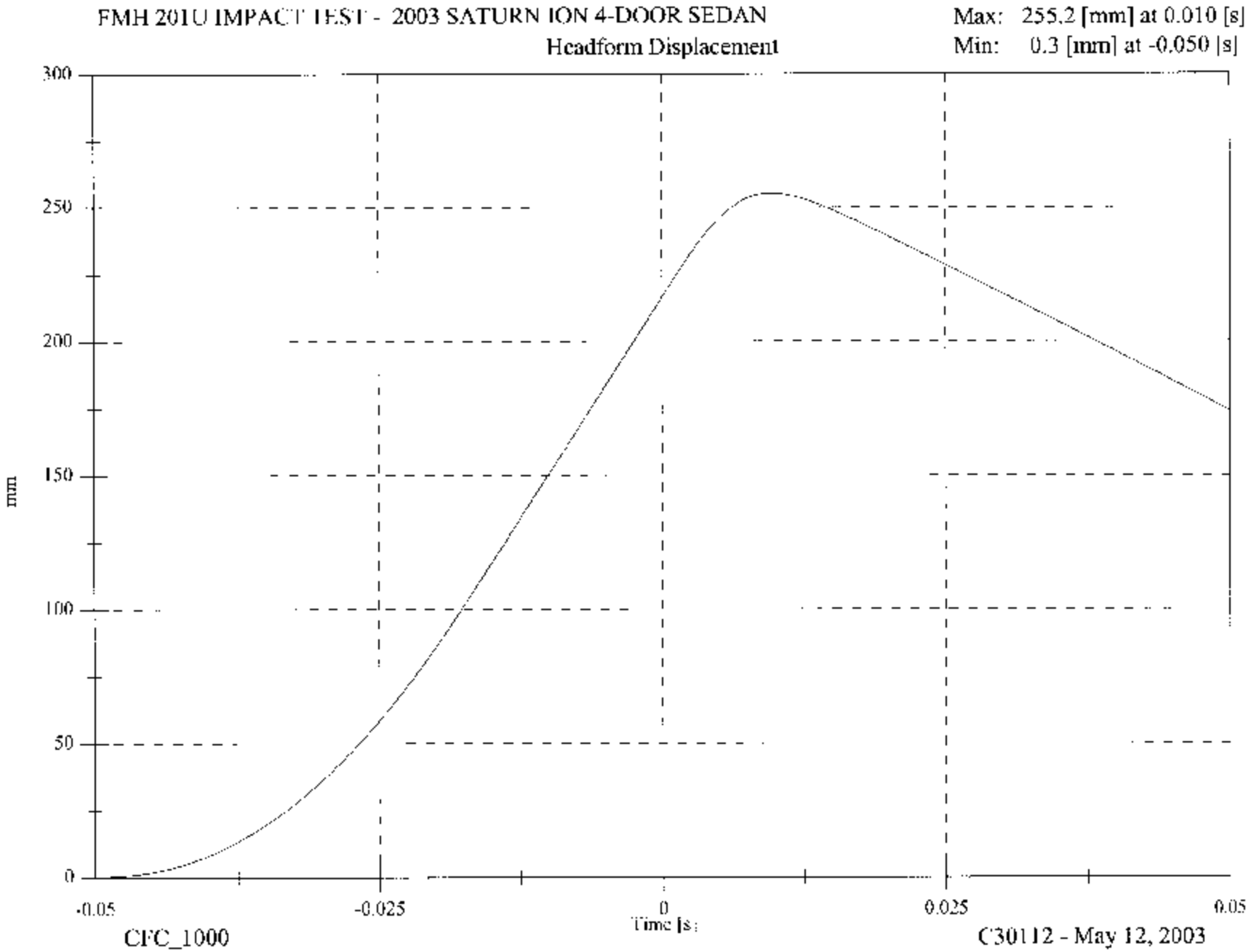

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Velocity
Max: 23.9 [KPH] at -0.014 [s]
Min: -8.0 [KPH] at 0.050 [s]
C30112 PASSENGER SIDE API IMPACT PLOT #5
KPH
25
20
15
10
5
0
-5
-10
-0 05
-0.025
0
0.025
0.05
Time [s]
CFC_1000
C30112 - May 12, 2003

C30112 PASSENGER SIDE AP IMPACT PLOT #6



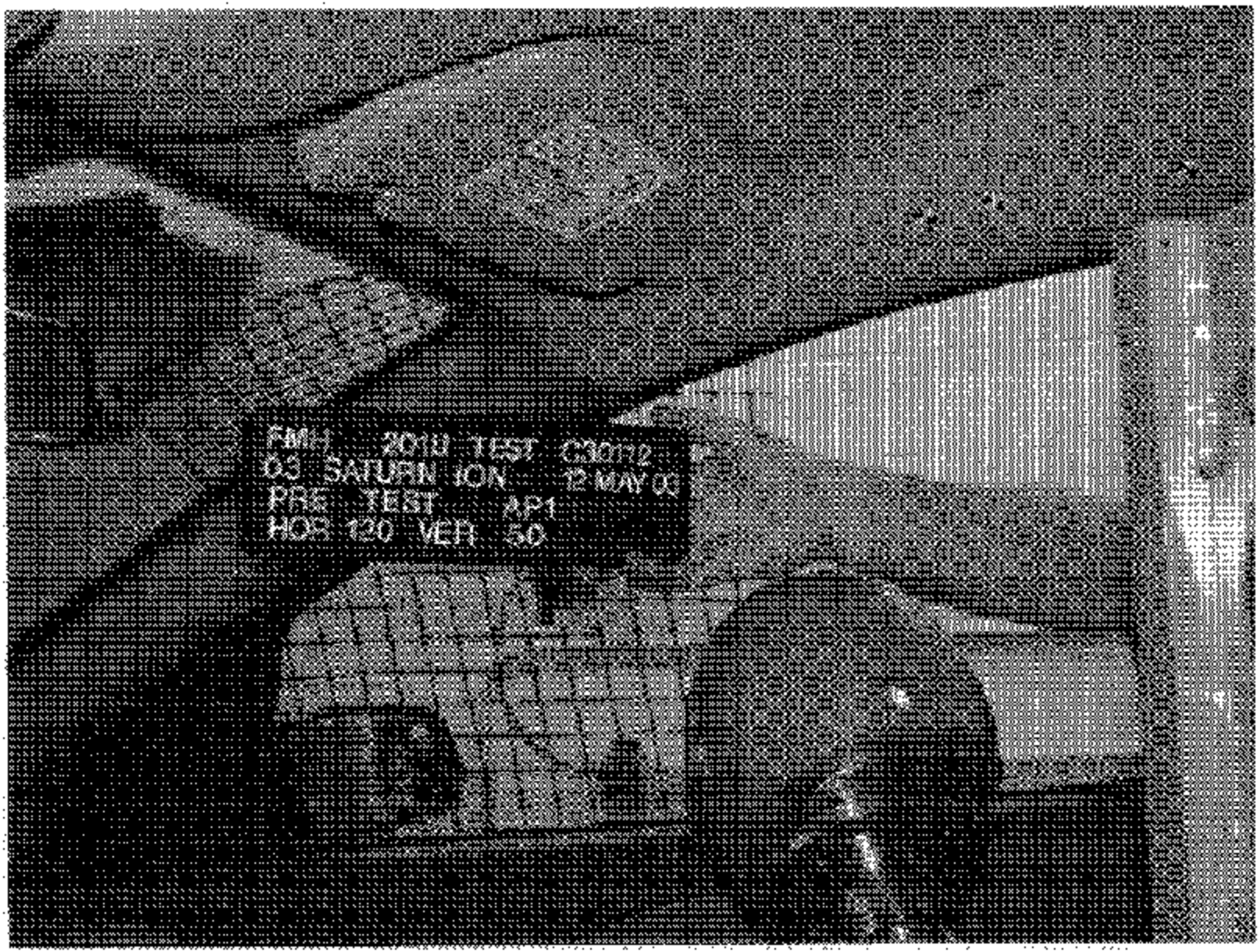


Figure : PRE-TEST AP1

Figure 1

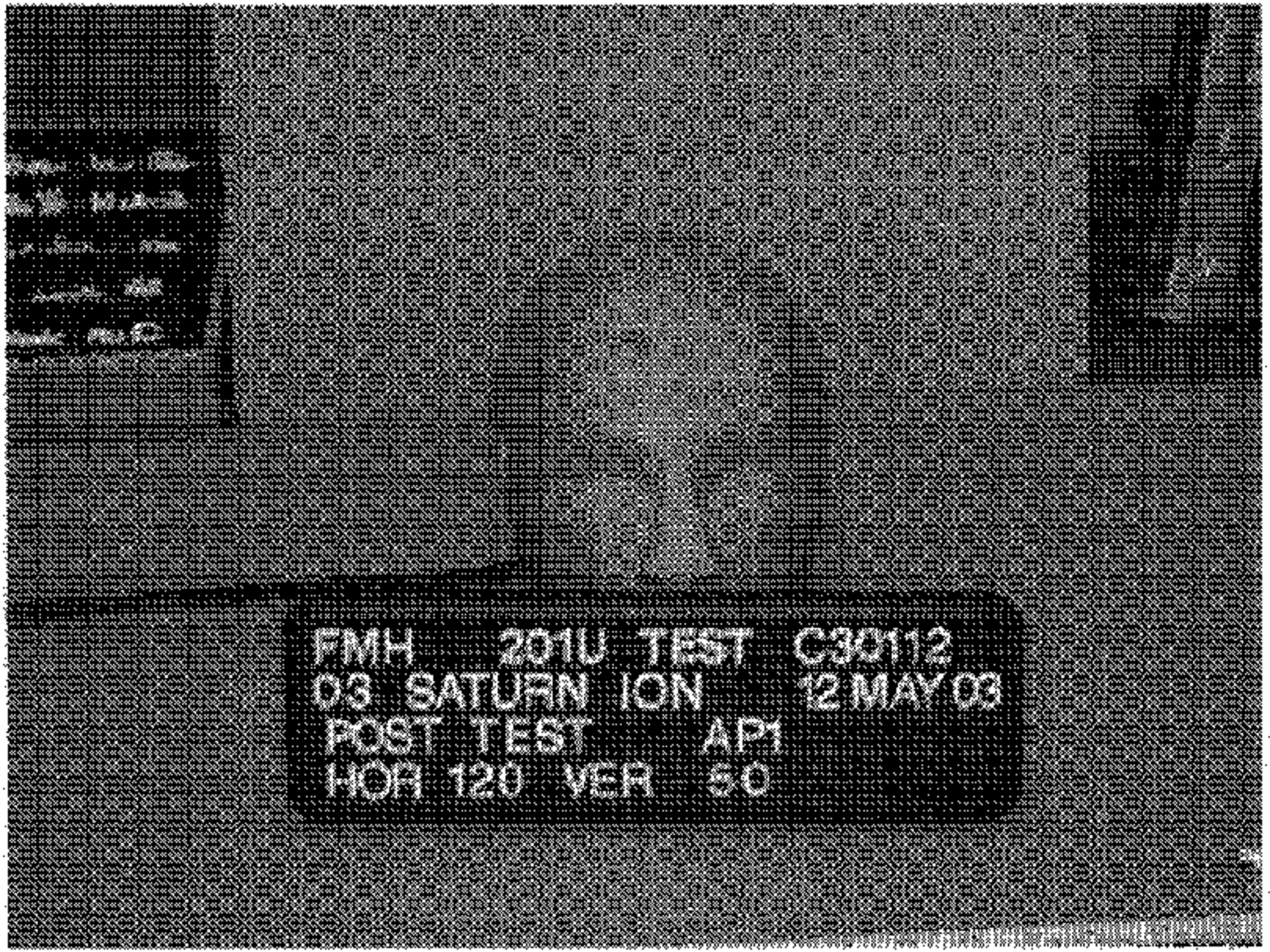


Figure : API HEADFORM

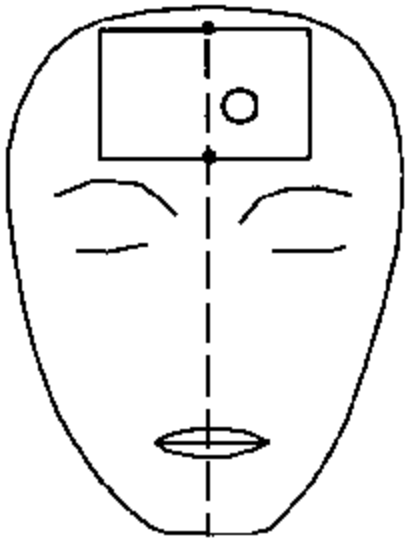
Year/Make/Model/Body Style:	2003 Saturn Ion 4-door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

Test Number:	3	Test Date:	MAY 12, 2003
Target Location:	B-PILLAR	Target Code:	BP4
Horizontal Impact Angle:	146 °	Vertical Impact Angle:	-8 °
Ambient Temperature:	22 °C	Time of Impact:	11:50
Headform Number:	0355		

Impact Point:

Description:

Description:	From lower midpoint				
On centerline	32	mm up			
On centerline	10	-	mm right	x	mm left



Free Motion HIC:	843.1	HIC(d).	802.5		
Impact Velocity (kph):	23.71	HICT1	4.2 msec	HICT2	9.4 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112 - BP4

FMH Headform 0355

Test Date: May 12, 2003

Location: BP4

Work File: BP4

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 32 %

Velocity at Impact: 23.71 KPH

Free Flight Distance: 215.66 mm

HICd: 802.5

HIC (36ms): 843.1

t1: 4.2 msec

t2: 9.4 msec

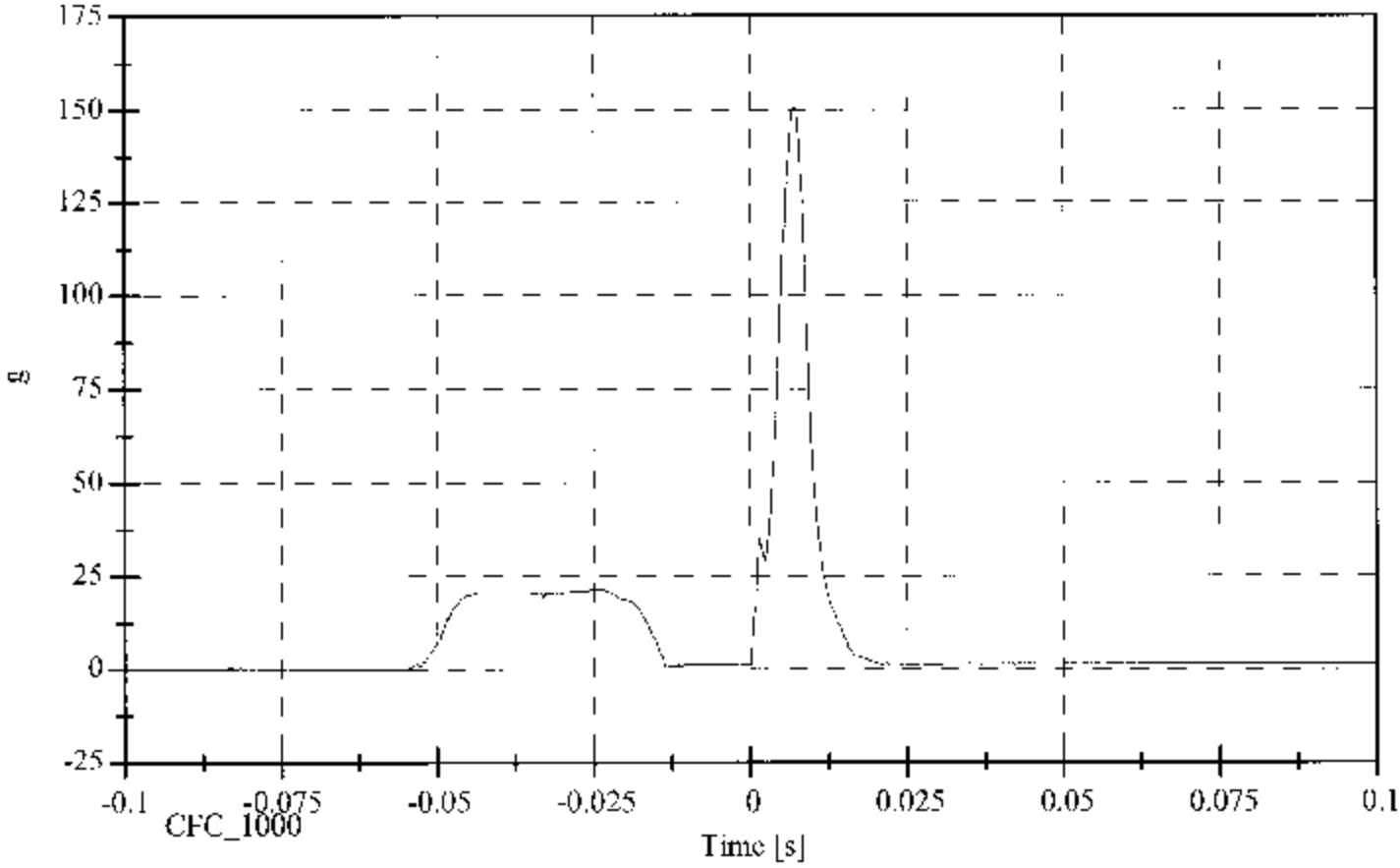
Duration: 5.2 msec

Average Acceleration: 8.7 g

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Resultant

Max: 150.7 [g] at 0.007 [s]

Min: -0.0 [g] at -0.099 [s]



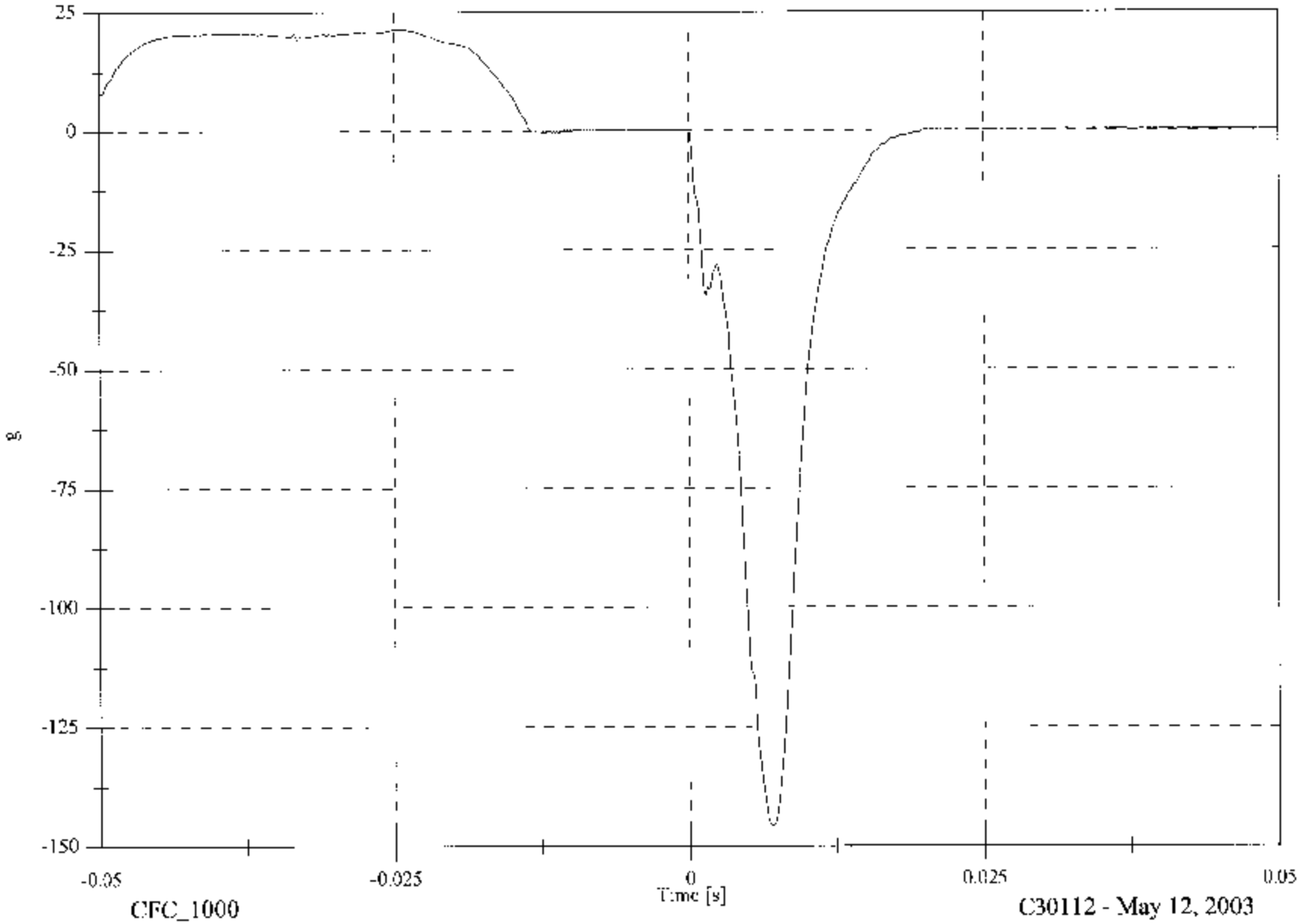
C30112 PASSENGER SIDE IIH4 IMPACT PLOT #1

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform X Acceleration

Max: 21.3 [g] at -0.024 [s]

Min: -145.7 [g] at 0.007 [s]



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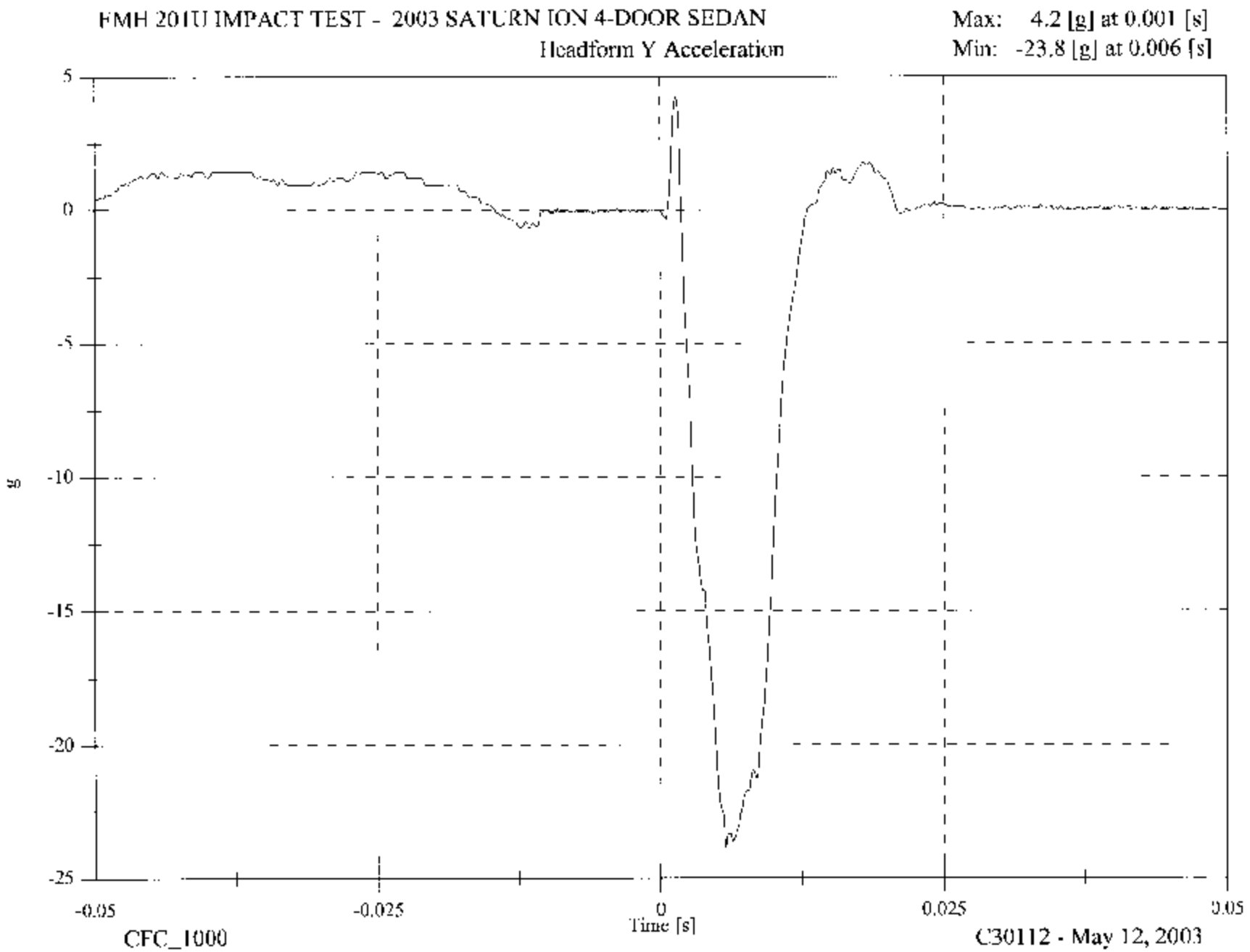
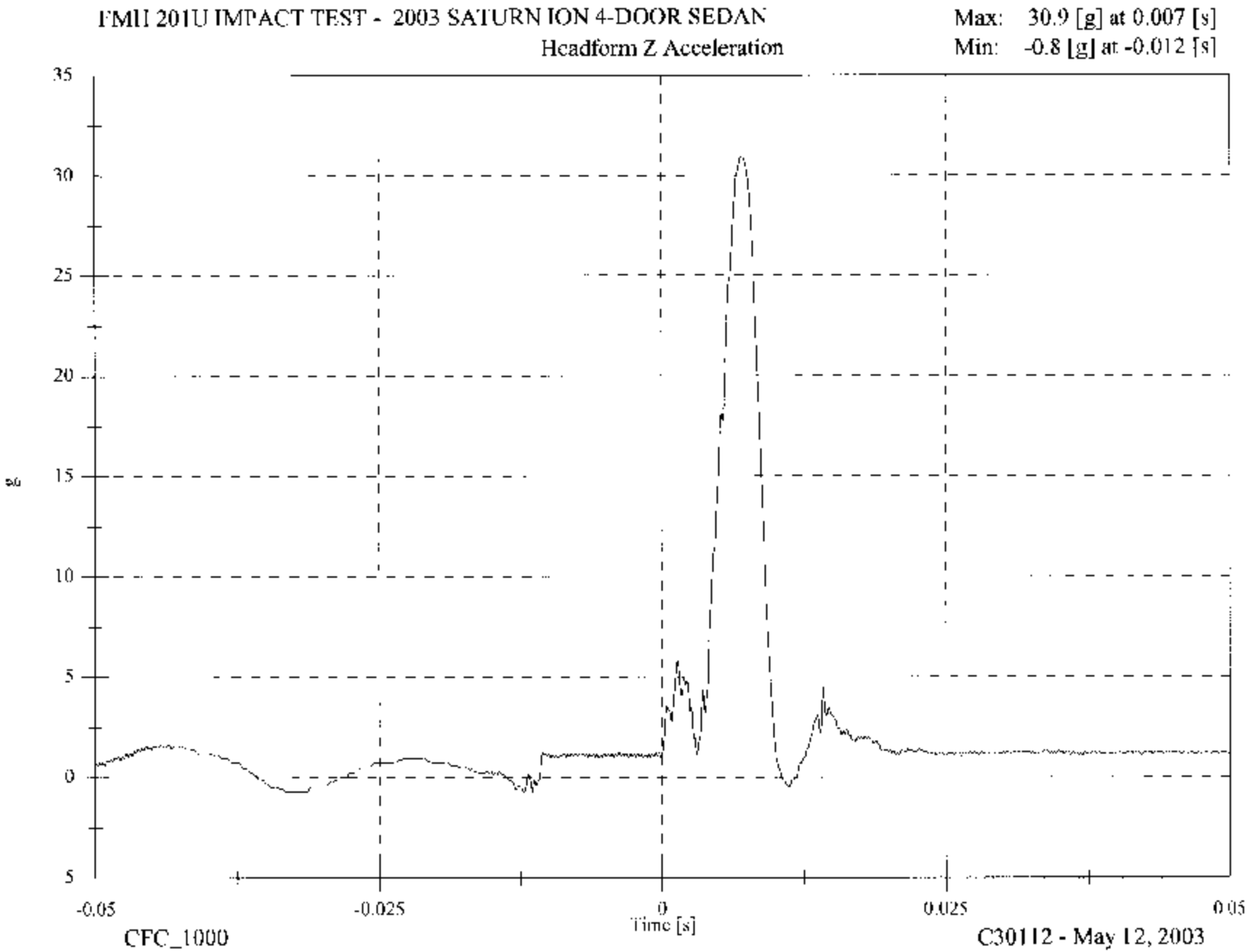
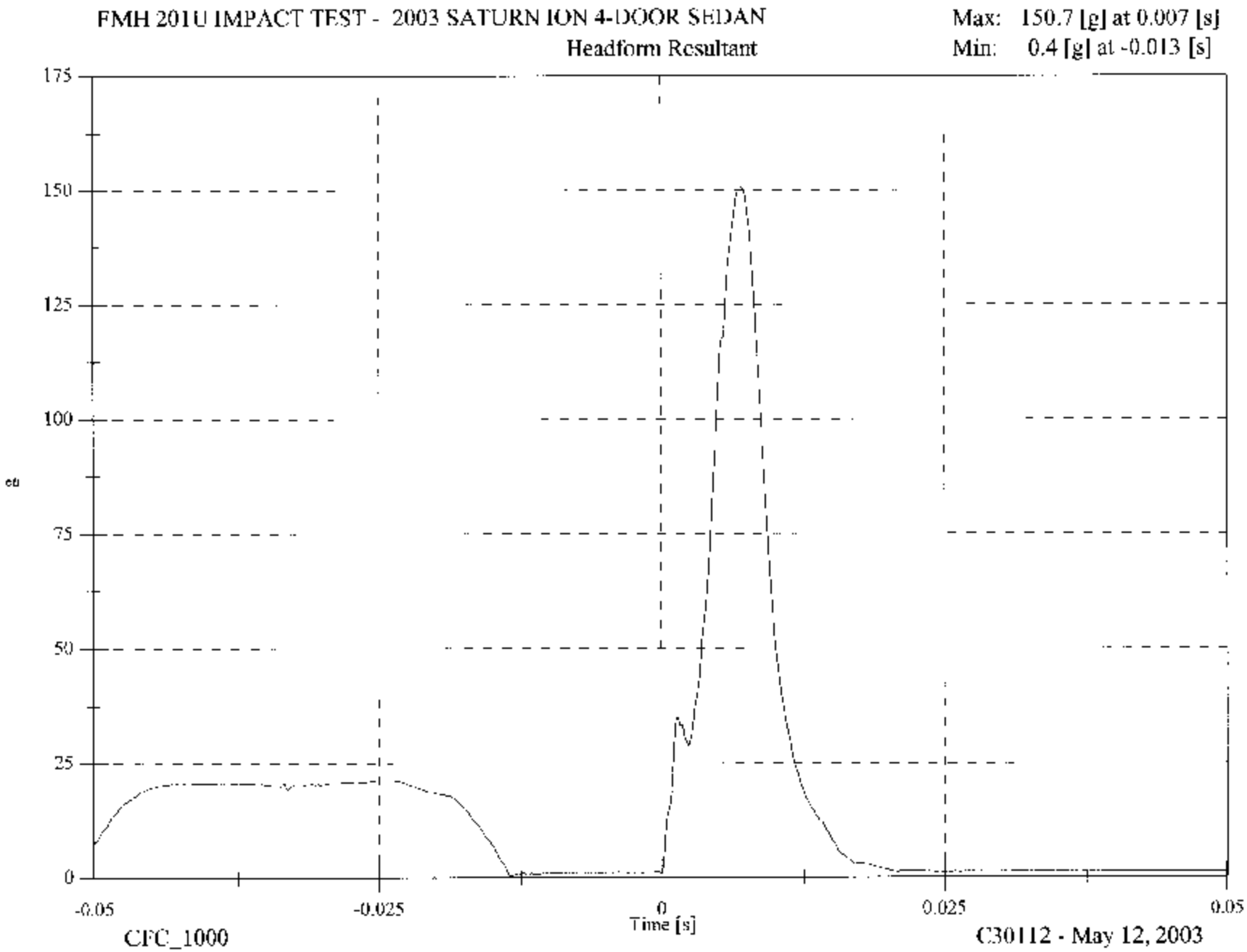
C30112 PASSENGER SIDE BP4 IMPACT PLOT #2



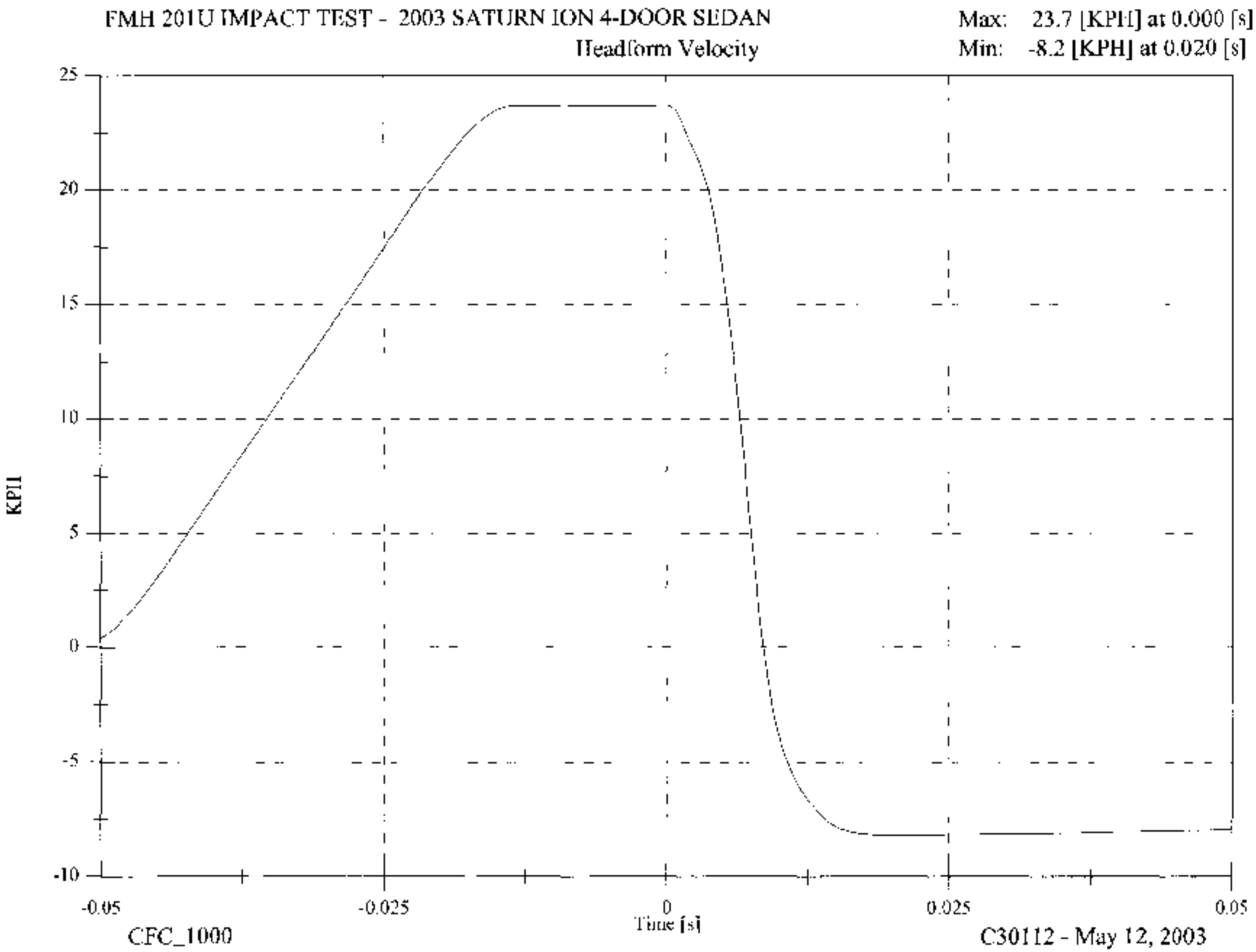
C30112 PASSENGER SIDE BP4 IMPACT PLOT #3



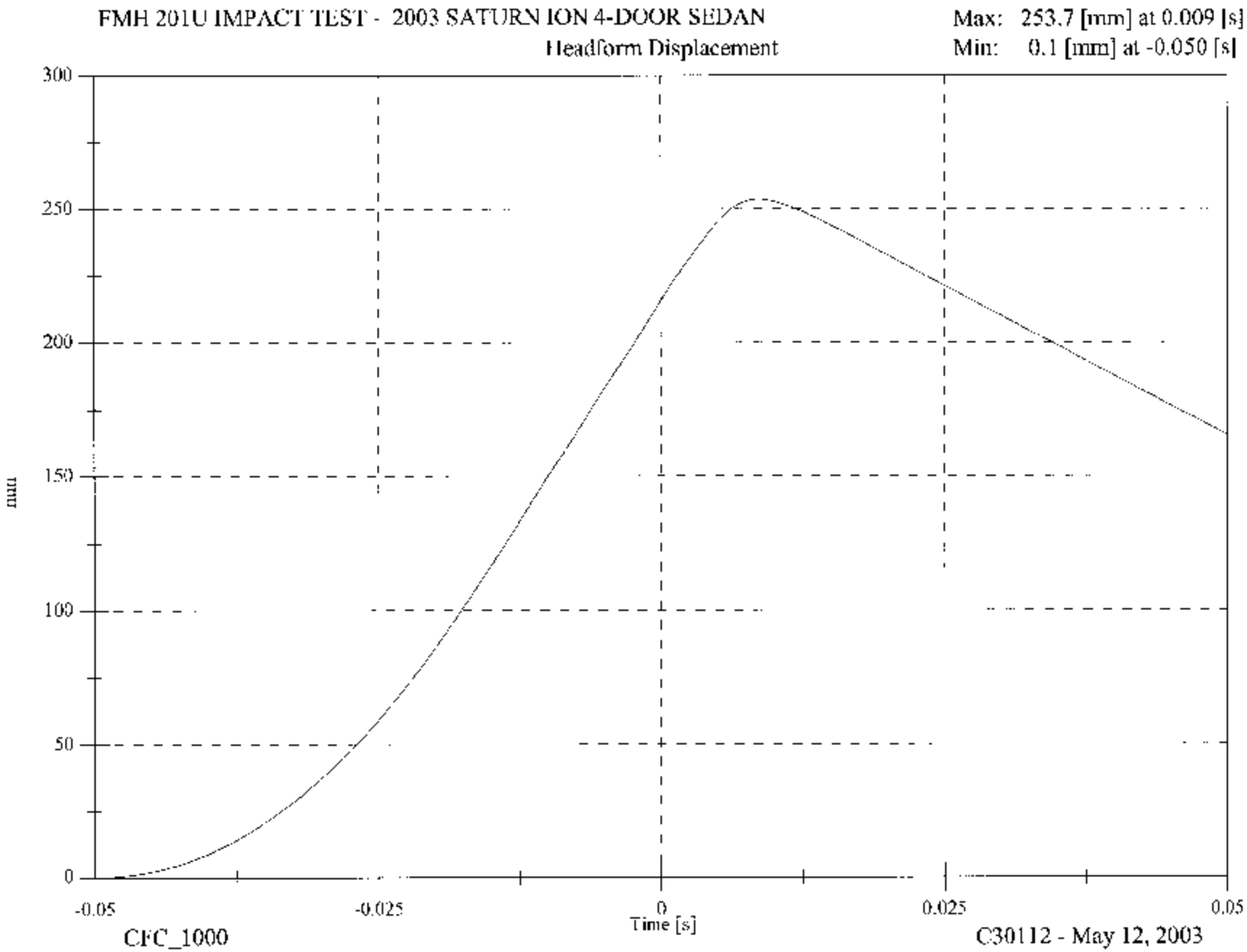
C30112 PASSENGER SIDE HP4 IMPACT PLOT #4



C30112 PASSENGER SIDE BP4 IMPACT PLOT #5



C30112 PASSENGER SIDE BP4 IMPACT PLOT #6



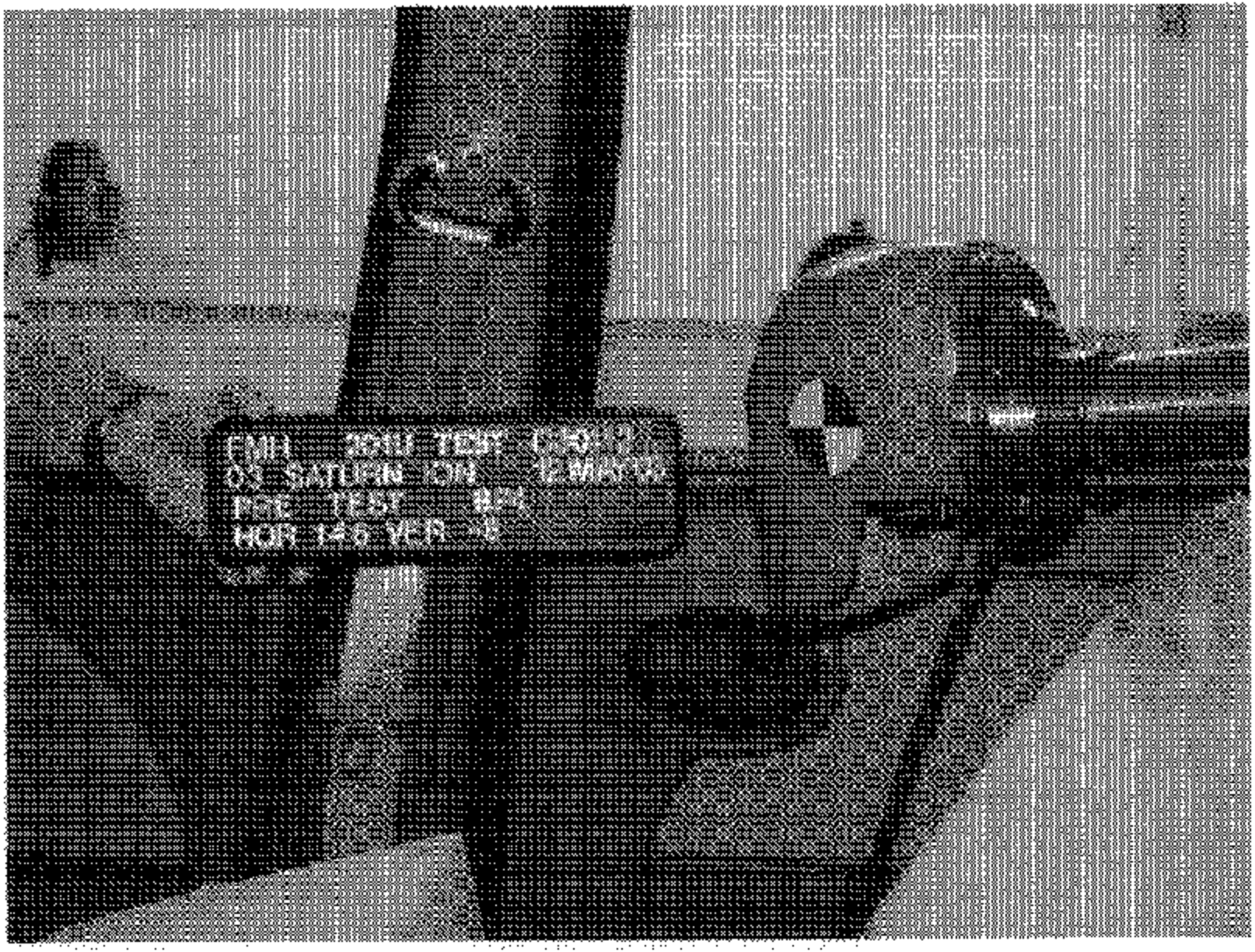


Figure : PRE-TEST B04

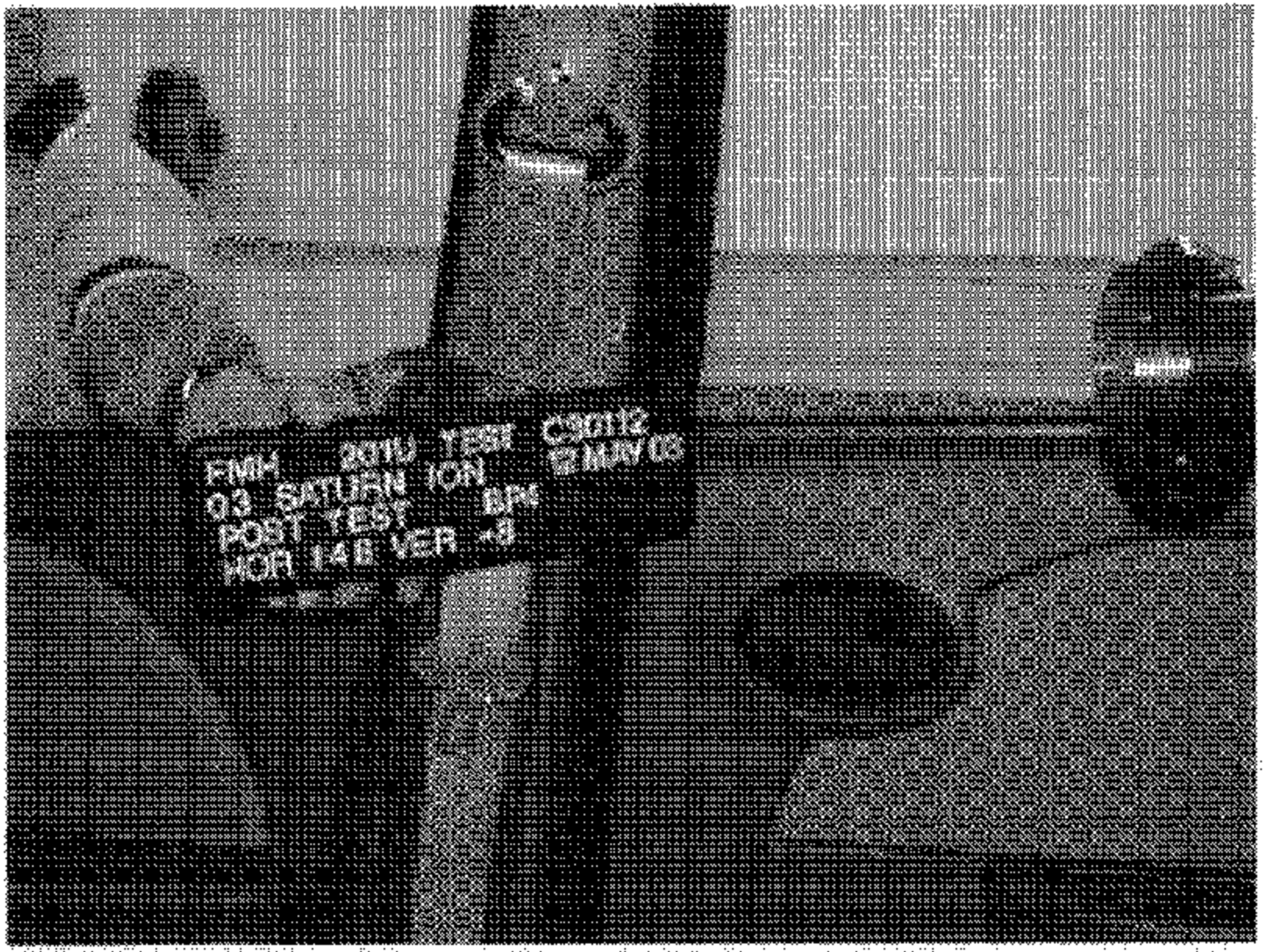


Figure : POST-TEST BP4

8633-FMH-12

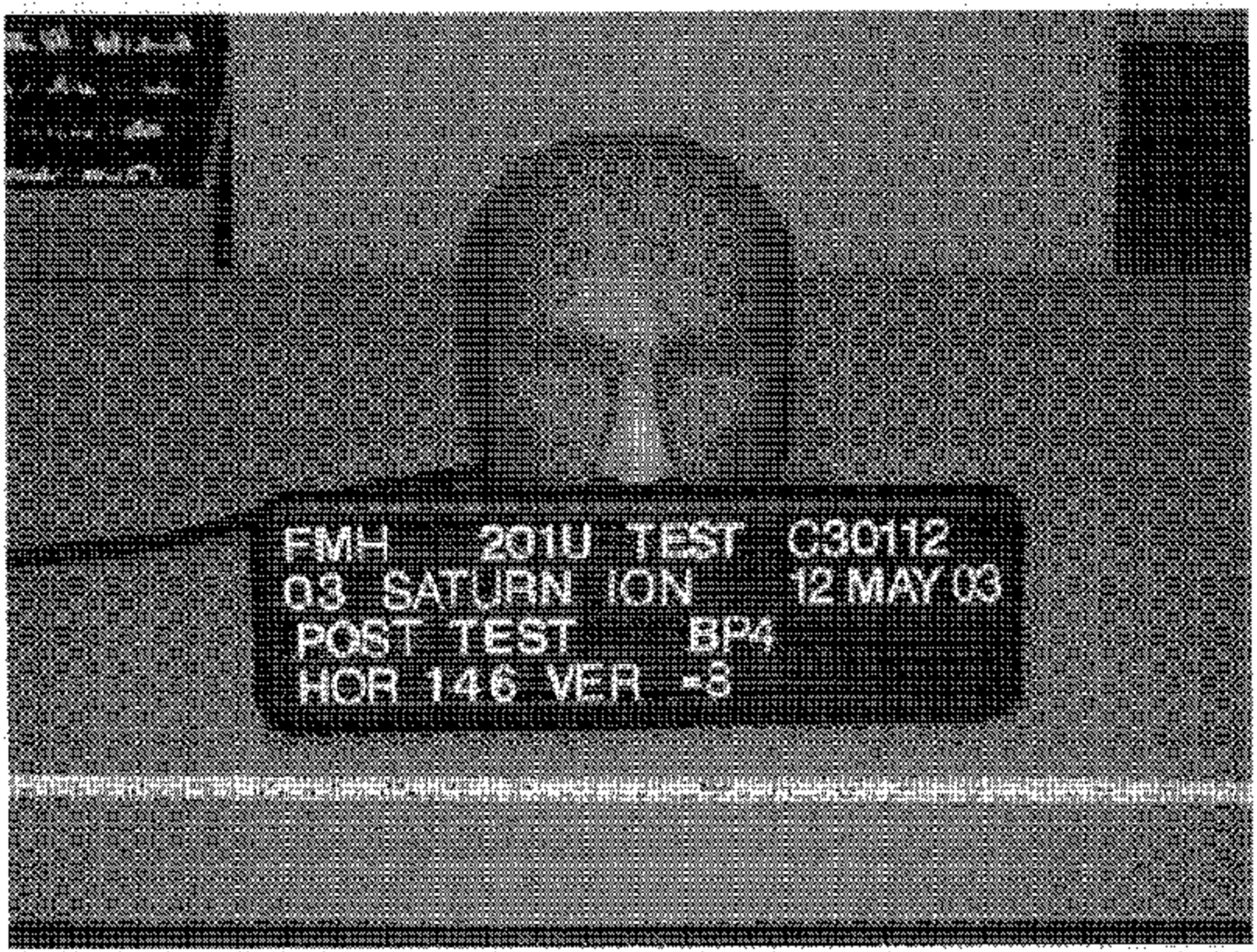


Figure : BPM HEADFORM

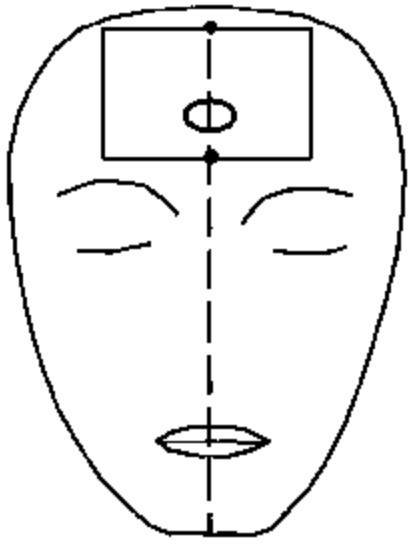
Year/Make/Model/Body Style:	2003 Saturn Ion 4-door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

Test Number:	4	Test Date:	MAY 12, 2003
Target Location:	REAR PILLAR	Target Code:	RP1
Horizontal Impact Angle:	78 °	Vertical Impact Angle:	27 °
Ambient Temperature:	22 °C	Time of Impact:	13:55
Headform Number:	0805		

Impact Point:

Description:

Description:	From lower midpoint				
On centerline	24	mm up			
On centerline	0	-	mm right	-	mm left



Free Motion HIC:	348.0	HIC(d):	428.9		
Impact Velocity (kph):	23.69	HICT1	4.3 msec	HICT2	14.8 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112 - RP1

FMH Headform 805

Test Date: May 12, 2003

Location: RP1

Work File: RP1

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 32 %

Velocity at Impact: 23.69 KPH

Free Flight Distance: 218.80 mm

HICd: 428.9

HIC (36ms): 348.0

t1: 4.3 msec

t2: 14.8 msec

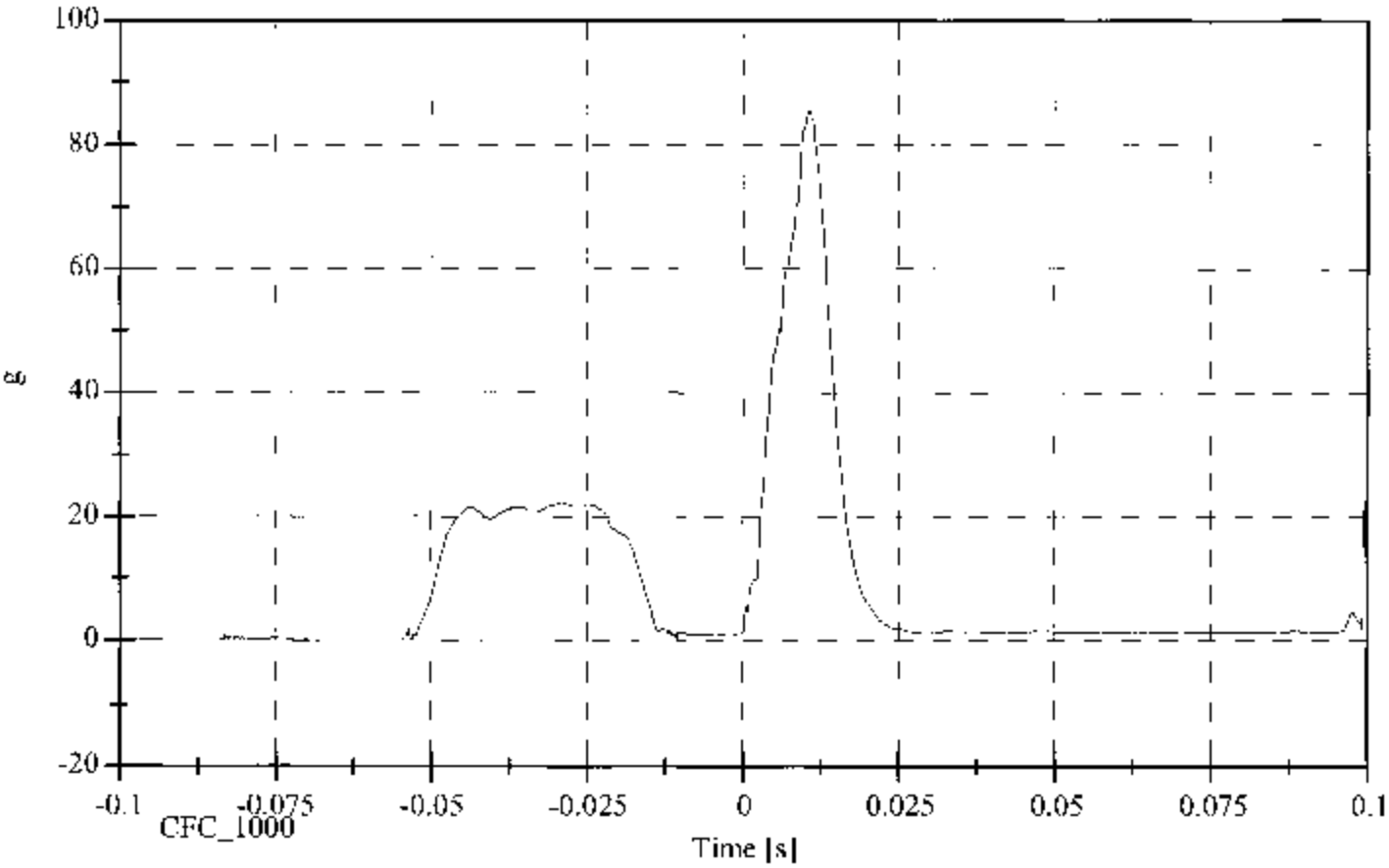
Duration: 10.5 msec

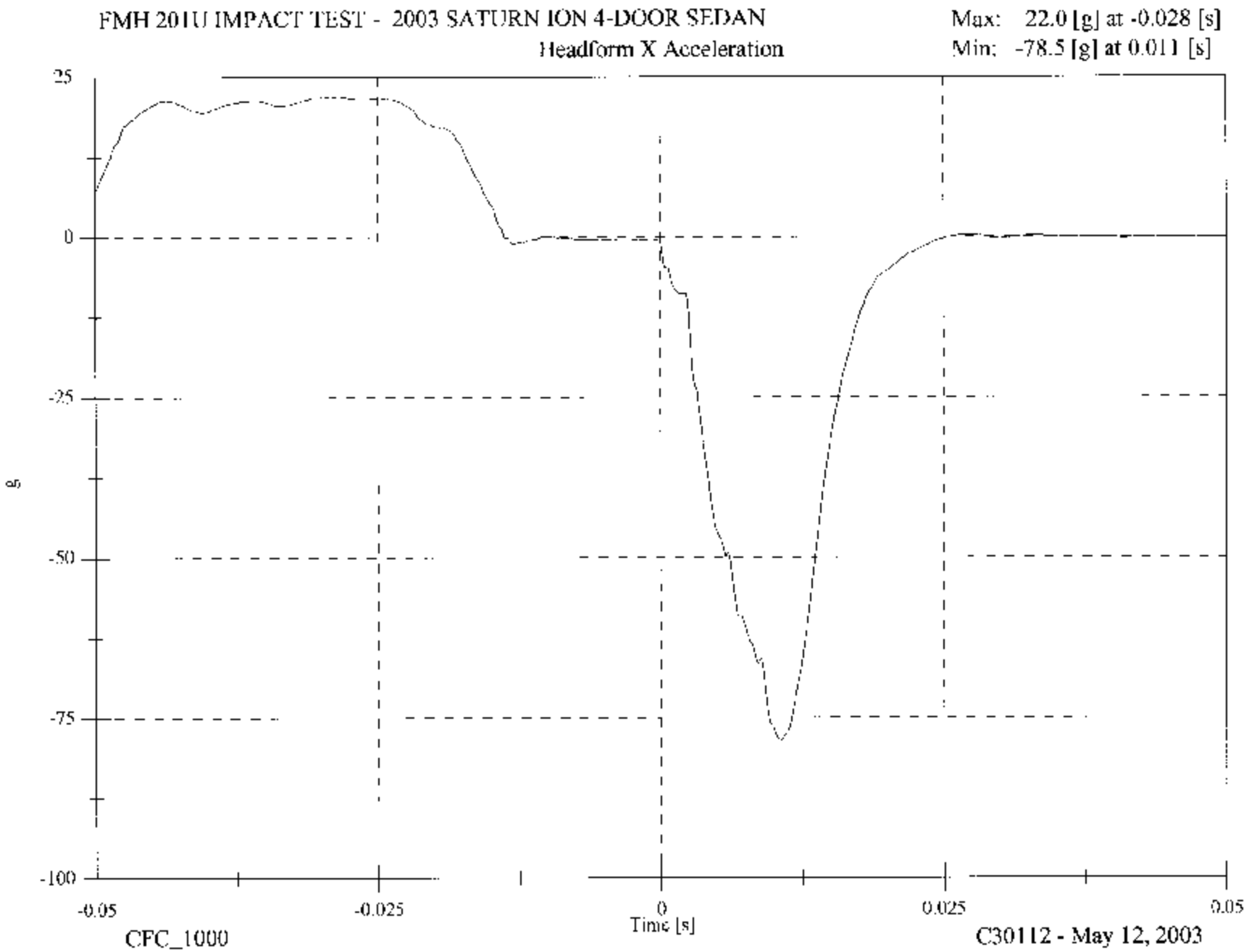
Average Acceleration: 8.3 g

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Resultant

Max: 85.7 [g] at 0.011 [s]

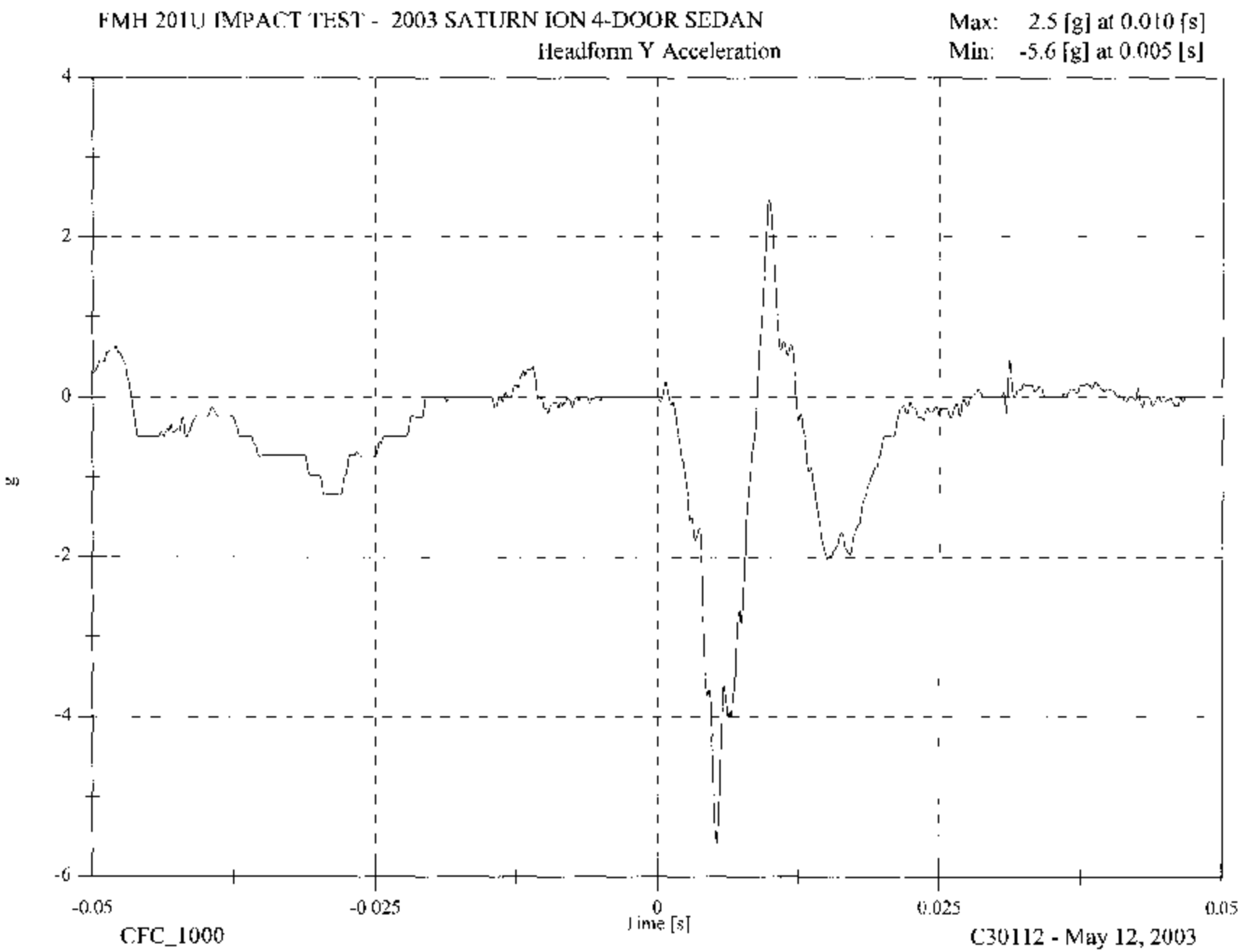
Min: -0.0 [g] at -0.099 [s]



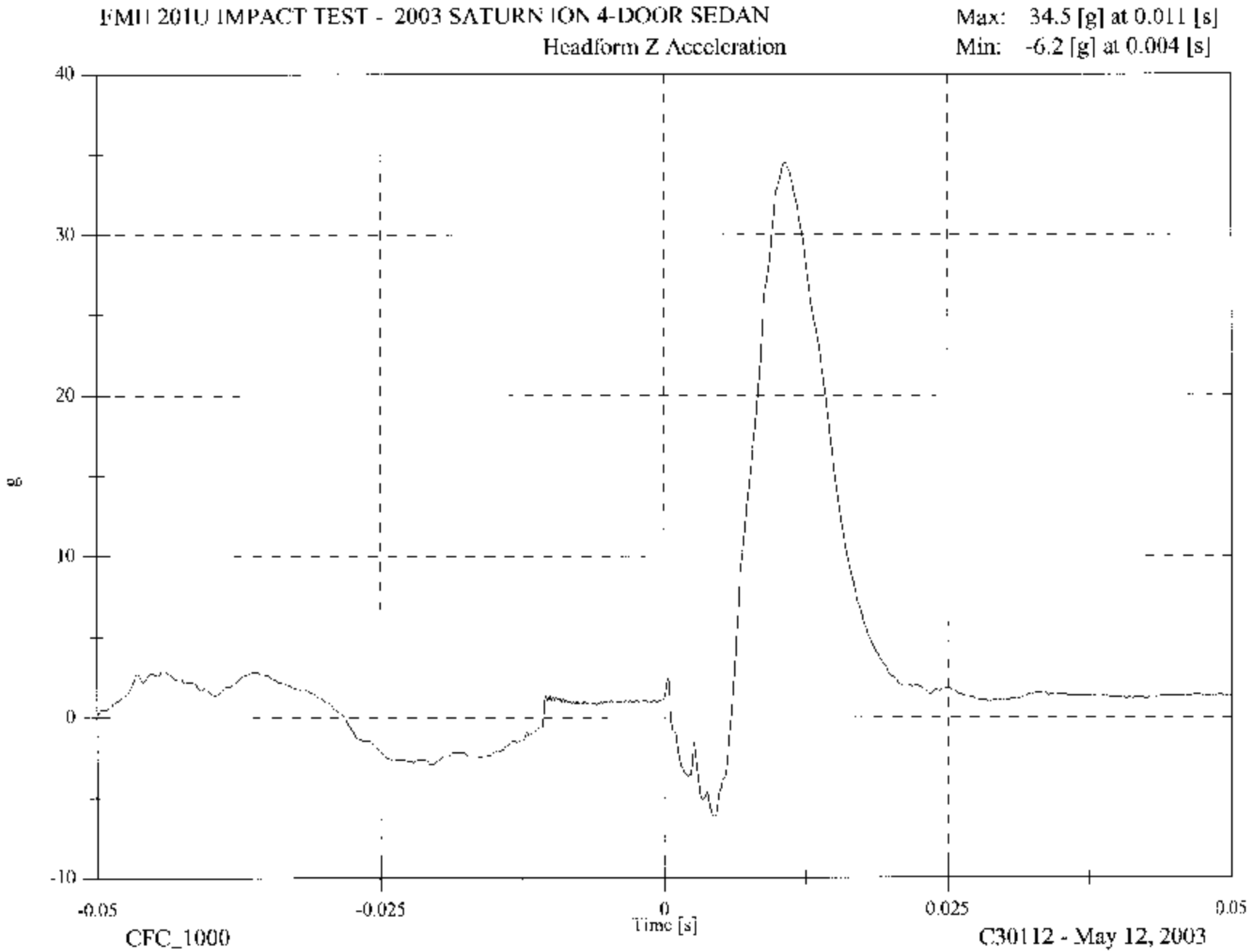


C30112 RP1 PASSENGER SIDE IMPACT PLOT #1

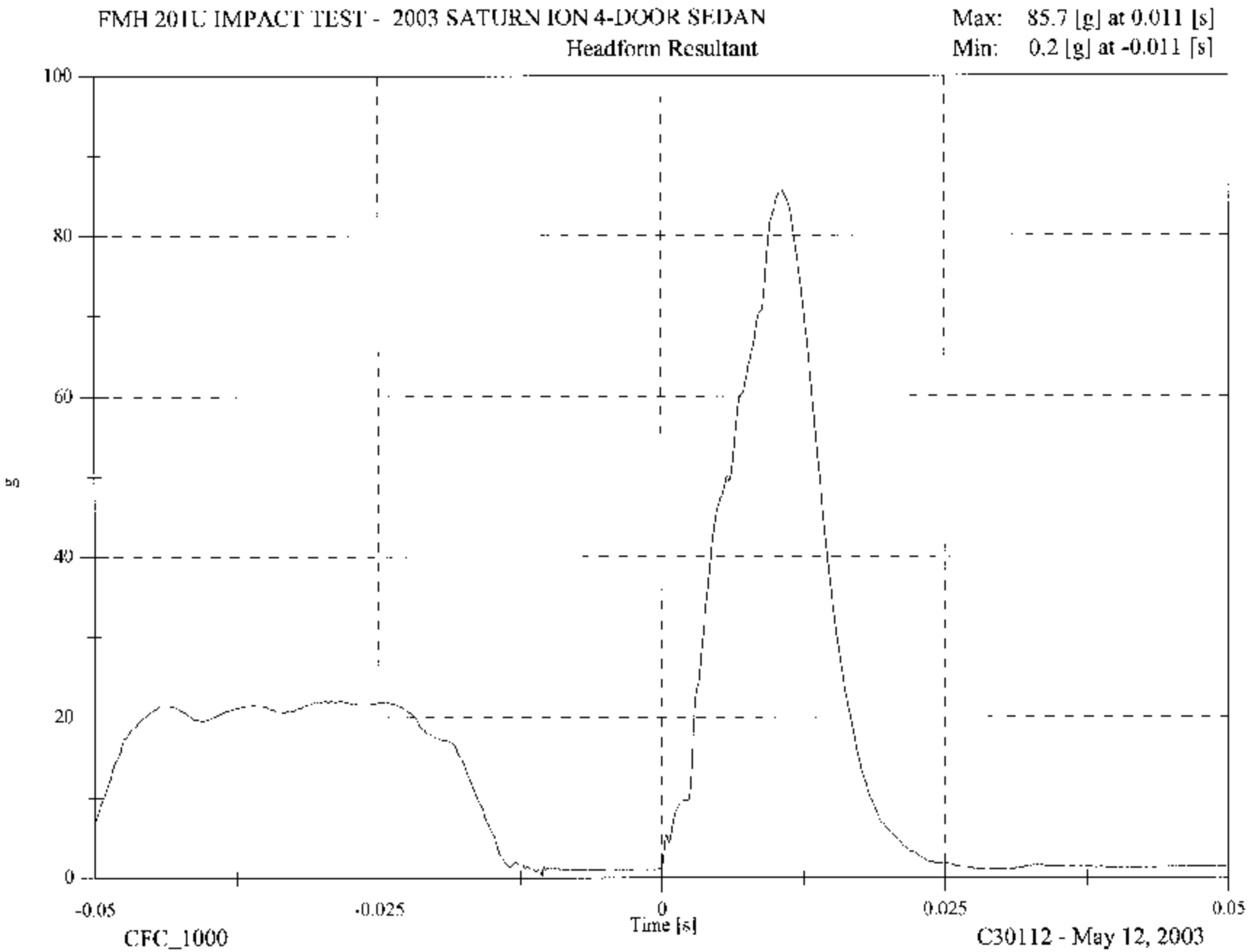
C30112 RP1 PASSENGER SIDE IMPACT PLOT #2



C30112 RPI PASSENGER SIDE IMPACT PLOT #3



C30112 RP1 PASSENGER SIDE IMPACT PLOT #4



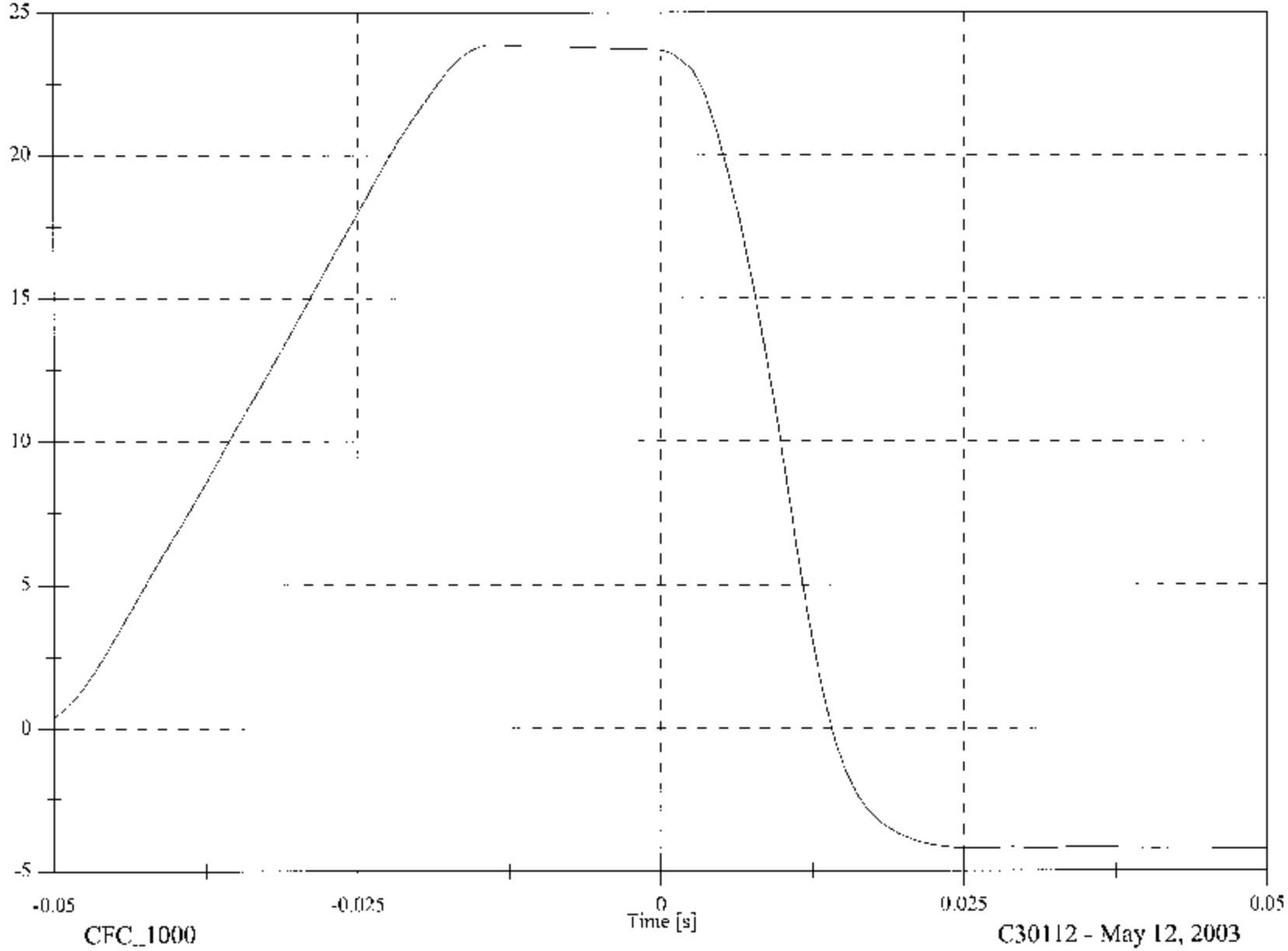
C30112 RP1 PASSENGER SIDE IMPACT PLOT #5

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Velocity

Max: 23.9 [KPH] at -0.014 [s]

Min: -4.2 [KPH] at 0.050 [s]



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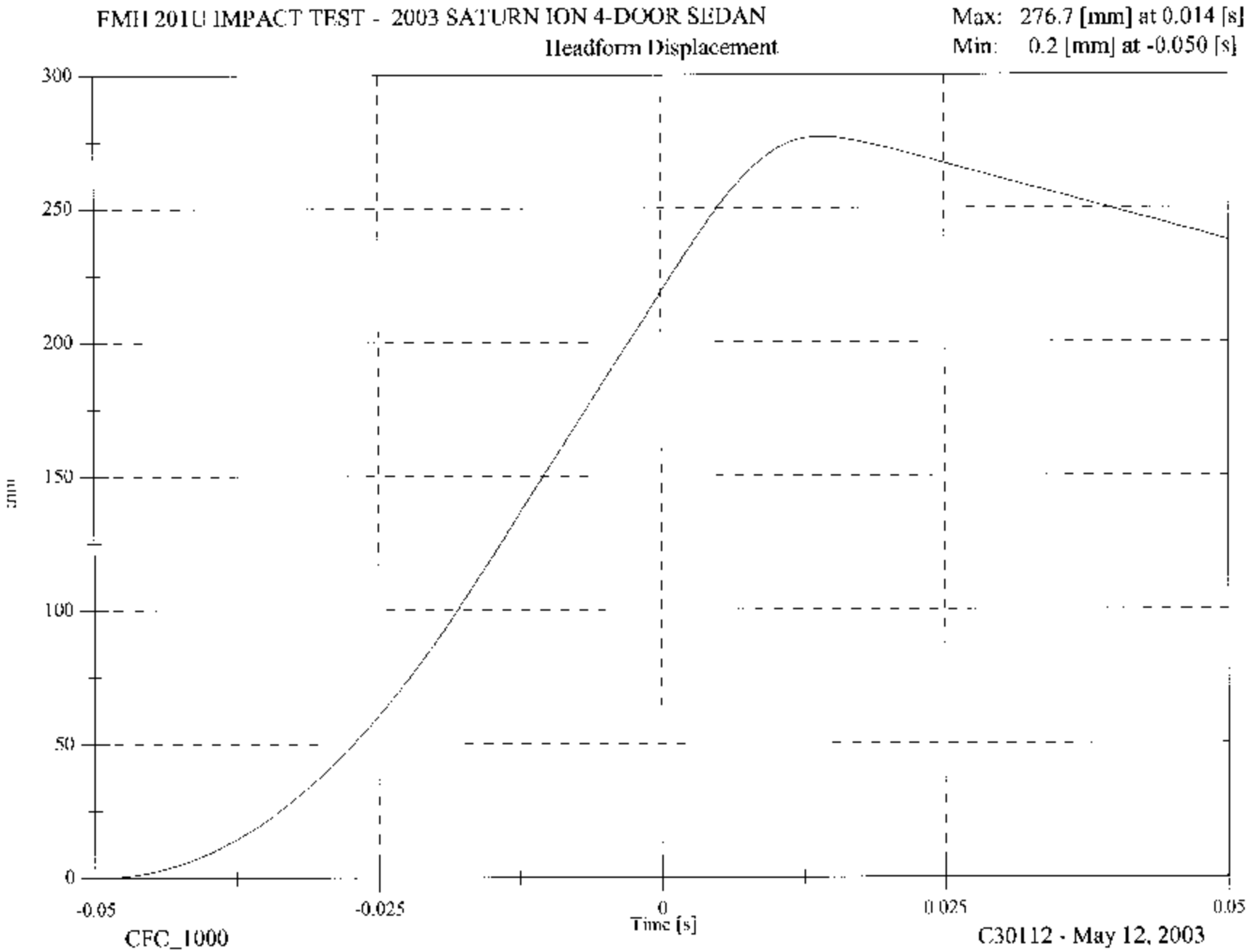


C30112 RF1 PASSENGER SIDE IMPACT PLOT #6

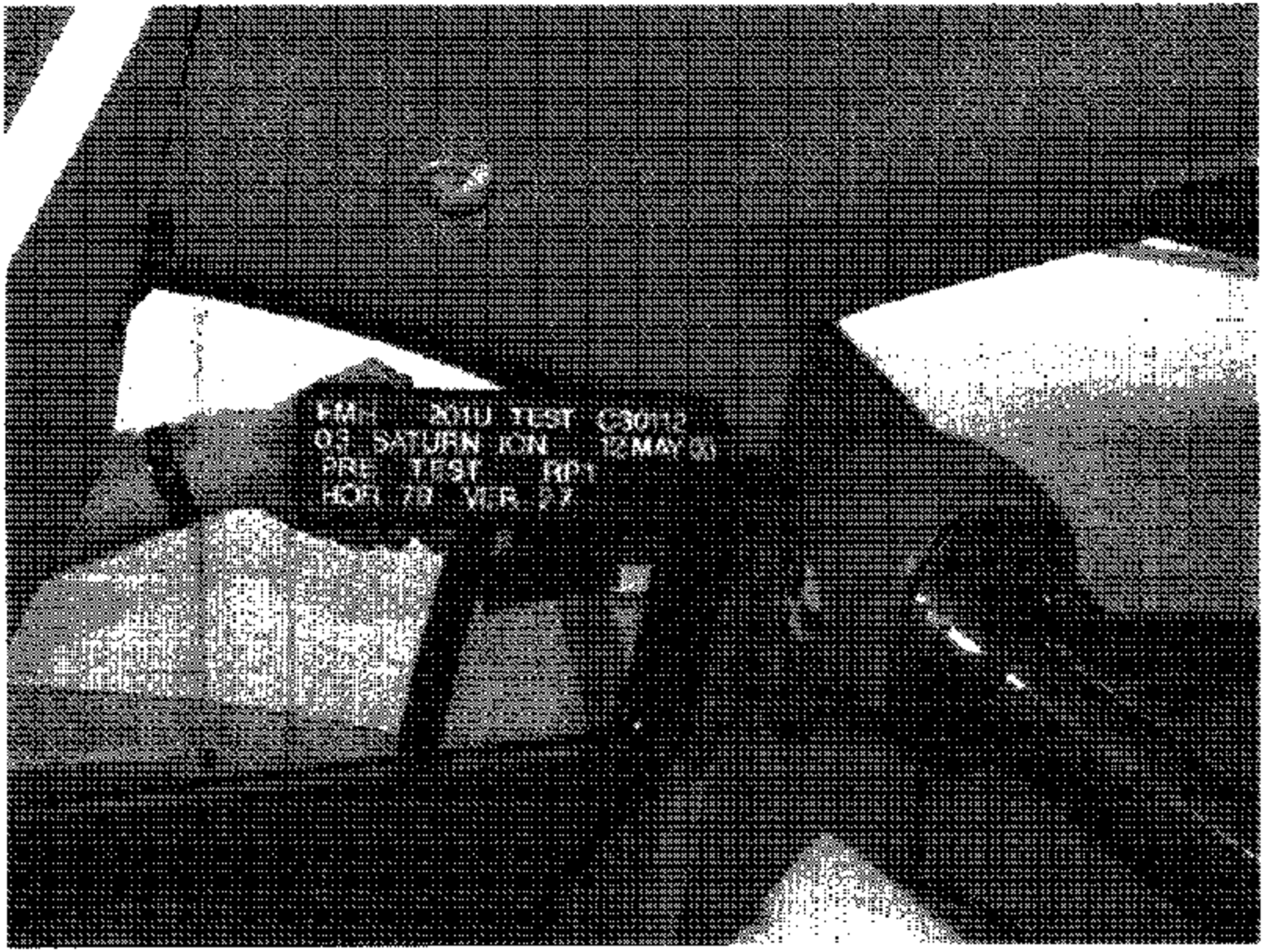
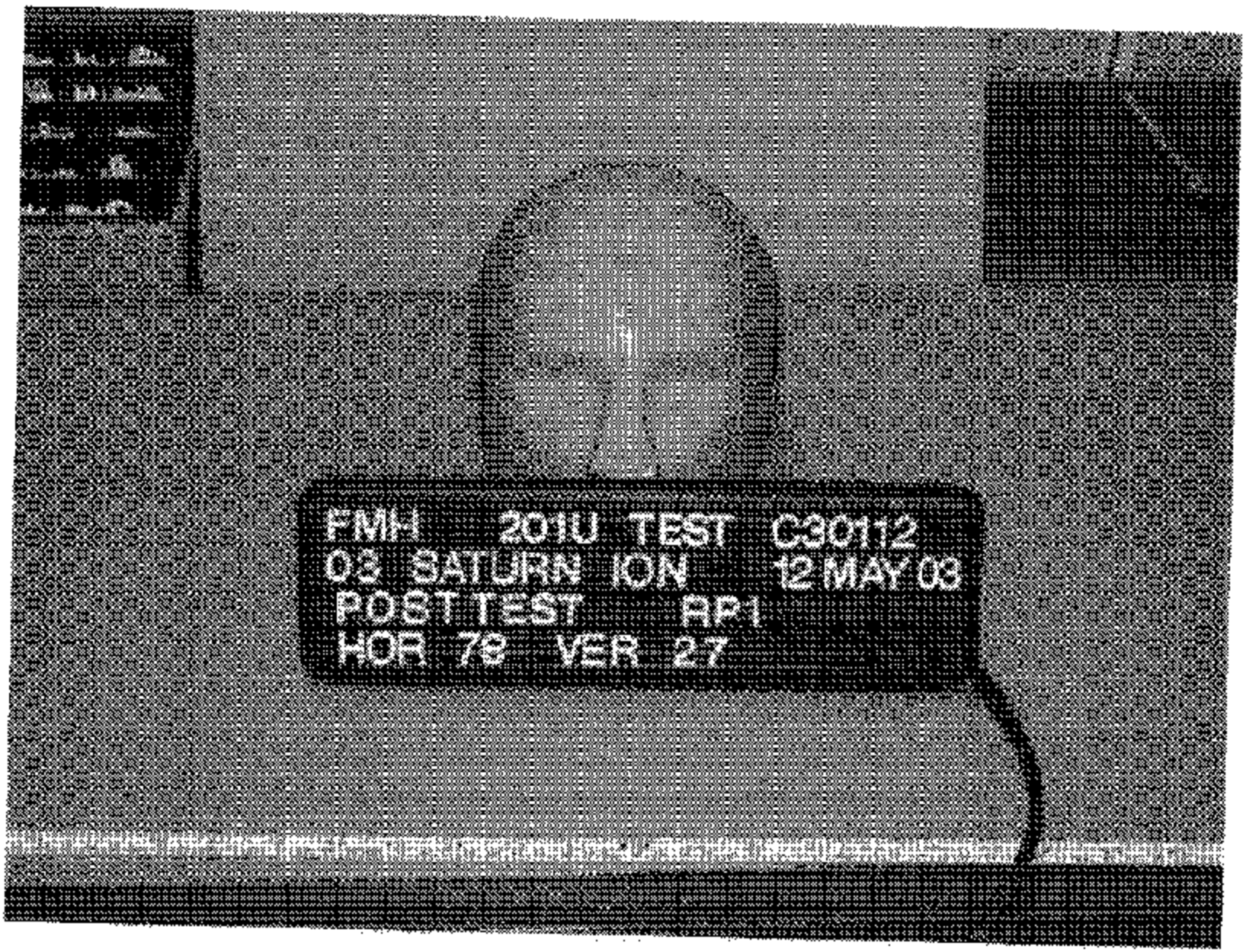


Figure PRE-FLIGHT RPI

Figure : POST-TEST RP1



8653-FMH-12

Figure . RP1 HEADFORM

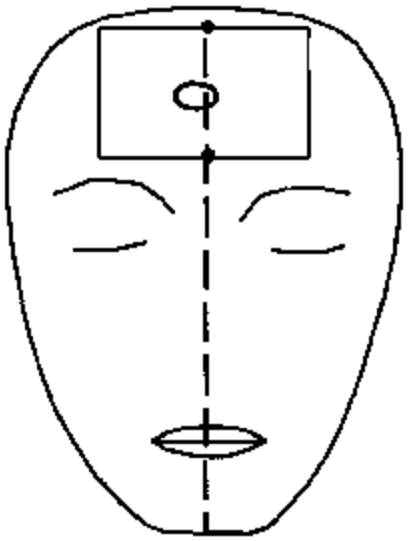
Year/Make/Model/Body Style:	2003 Saturn Ion 4-door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

Test Number:	5	Test Date:	MAY 12, 2003
Target Location:	B-PILLAR	Target Code:	BP1
Horizontal Impact Angle:	90 °	Vertical Impact Angle:	22 °
Ambient Temperature:	22 °C	Time of Impact:	14:40
Headform Number:	1255		

Impact Point:

Description:

Description:	From lower midpoint				
On centerline	43	mm up			
On centerline	4	x	mm right	-	mm left



Free Motion HIC:	534.0	HIC(d):	569.3		
Impact Velocity (kph):	23.55	HICT1	2.9 msec	HICT2	11.9 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112 - BP1

FMH Headform 1255

Test Date: May 12, 2003

Location: BP1

Work File: BP1

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 32 %

Velocity at Impact: 23.55 KPH

Free Flight Distance: 212.40 mm

HICd: 569.3

HIC (36ms): 534.0

t1: 2.9 msec

t2: 11.9 msec

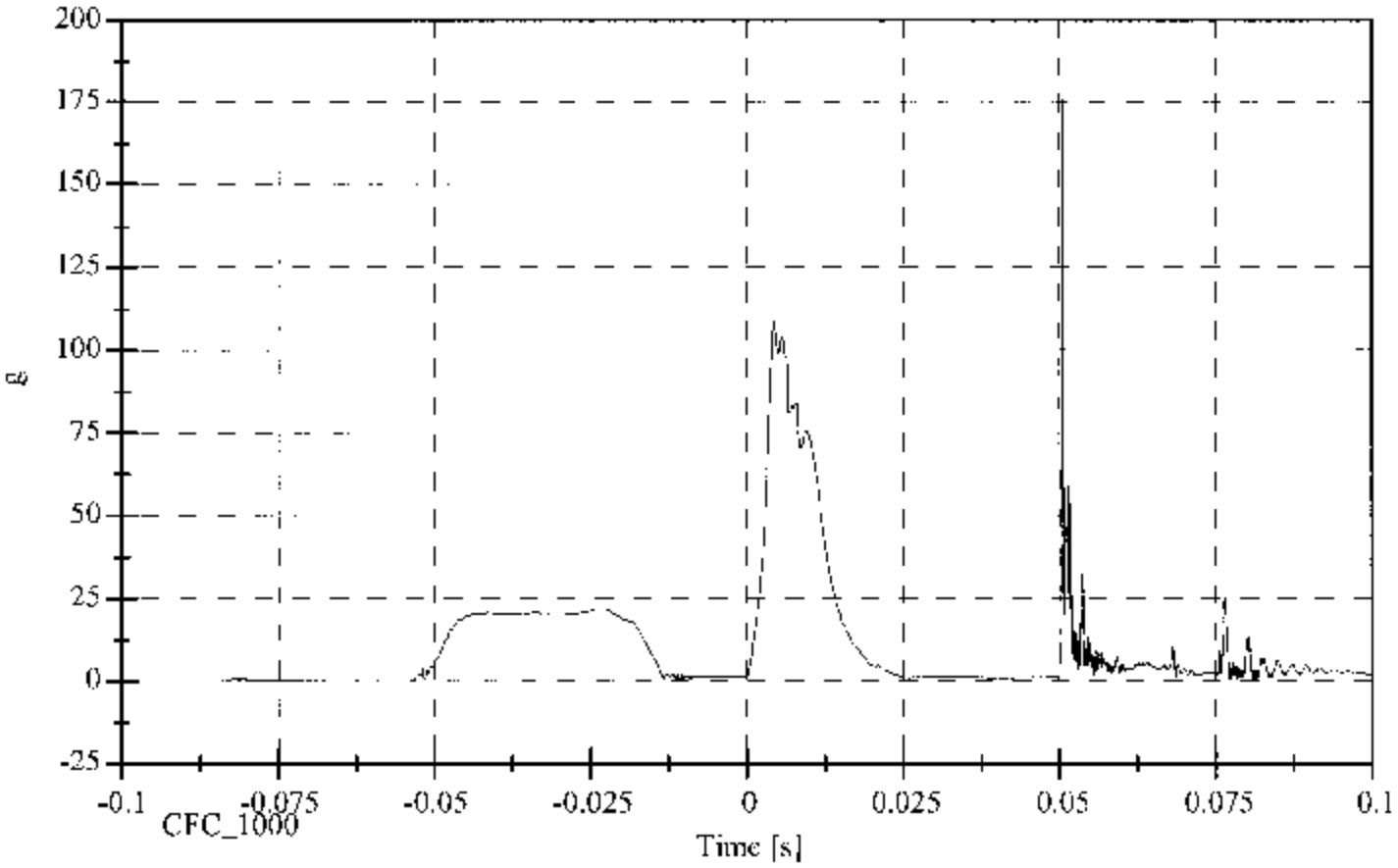
Duration: 9.0 msec

Average Acceleration: 9.9 g

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Resultant

Max: 175.7 [g] at 0.050 [s]

Min: -0.0 [g] at -0.099 [s]



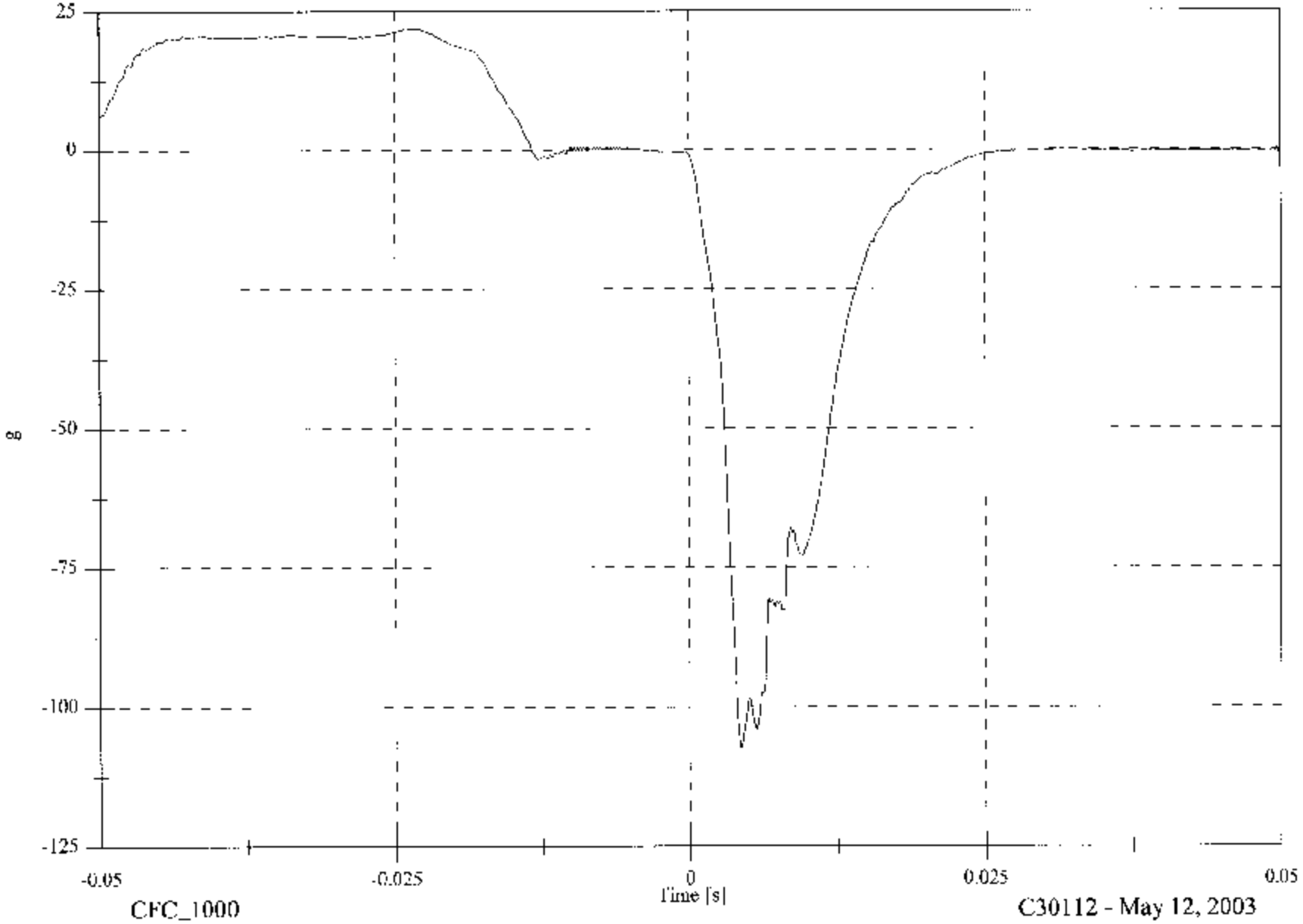
C30112 PASSENGER SIDE BP1 IMPACT PLOT #1

FMH 2010 IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform X Acceleration

Max: 22.0 [g] at -0.024 [s]

Min: -107.4 [g] at 0.004 [s]



CFC_1000

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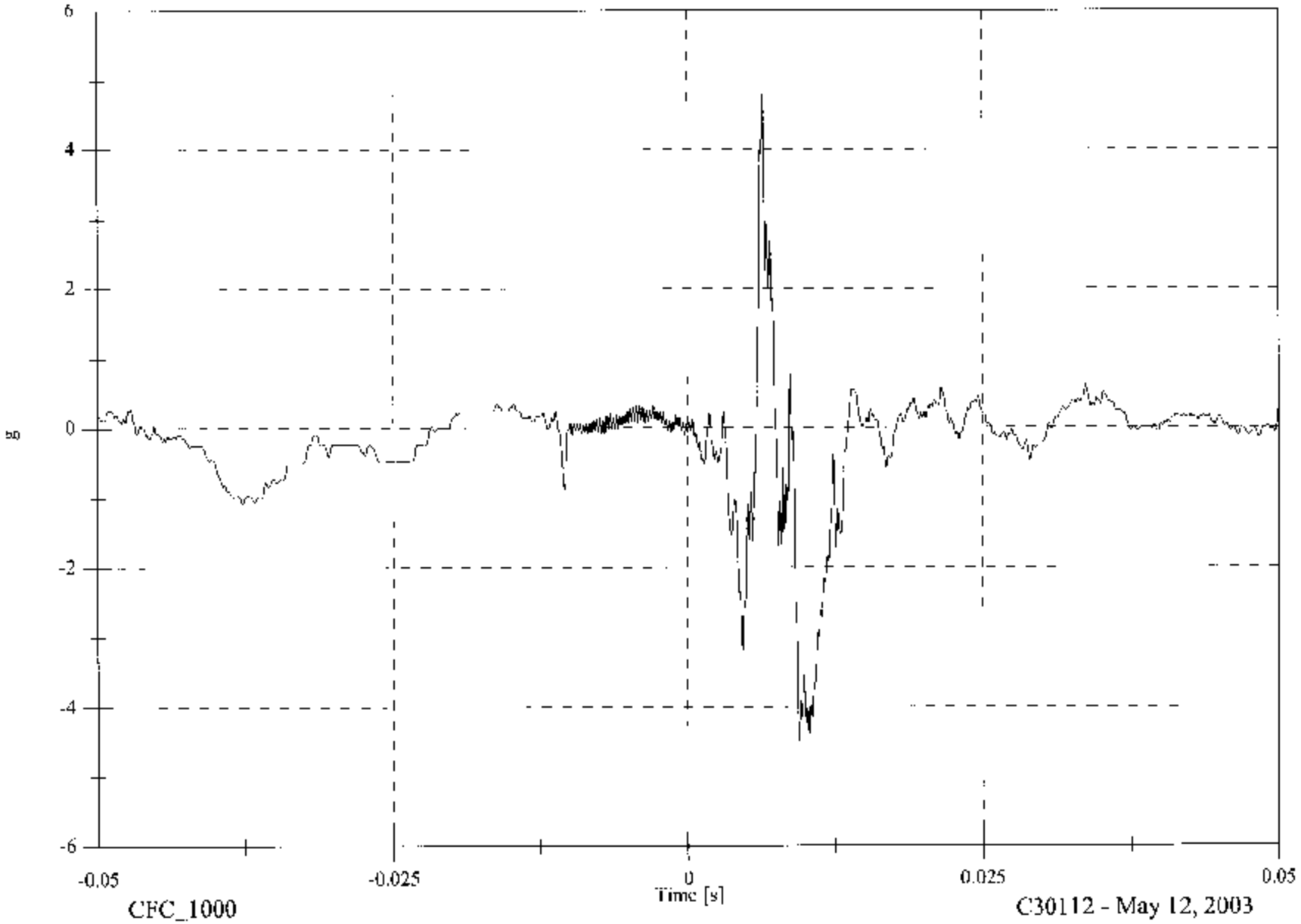
C30112 PASSENGER SIDE BP1 IMPACT PLOT #2

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Y Acceleration

Max: 4.8 [g] at 0.006 [s]

Min: -4.5 [g] at 0.009 [s]



CFC_1000

C30112 - May 12, 2003

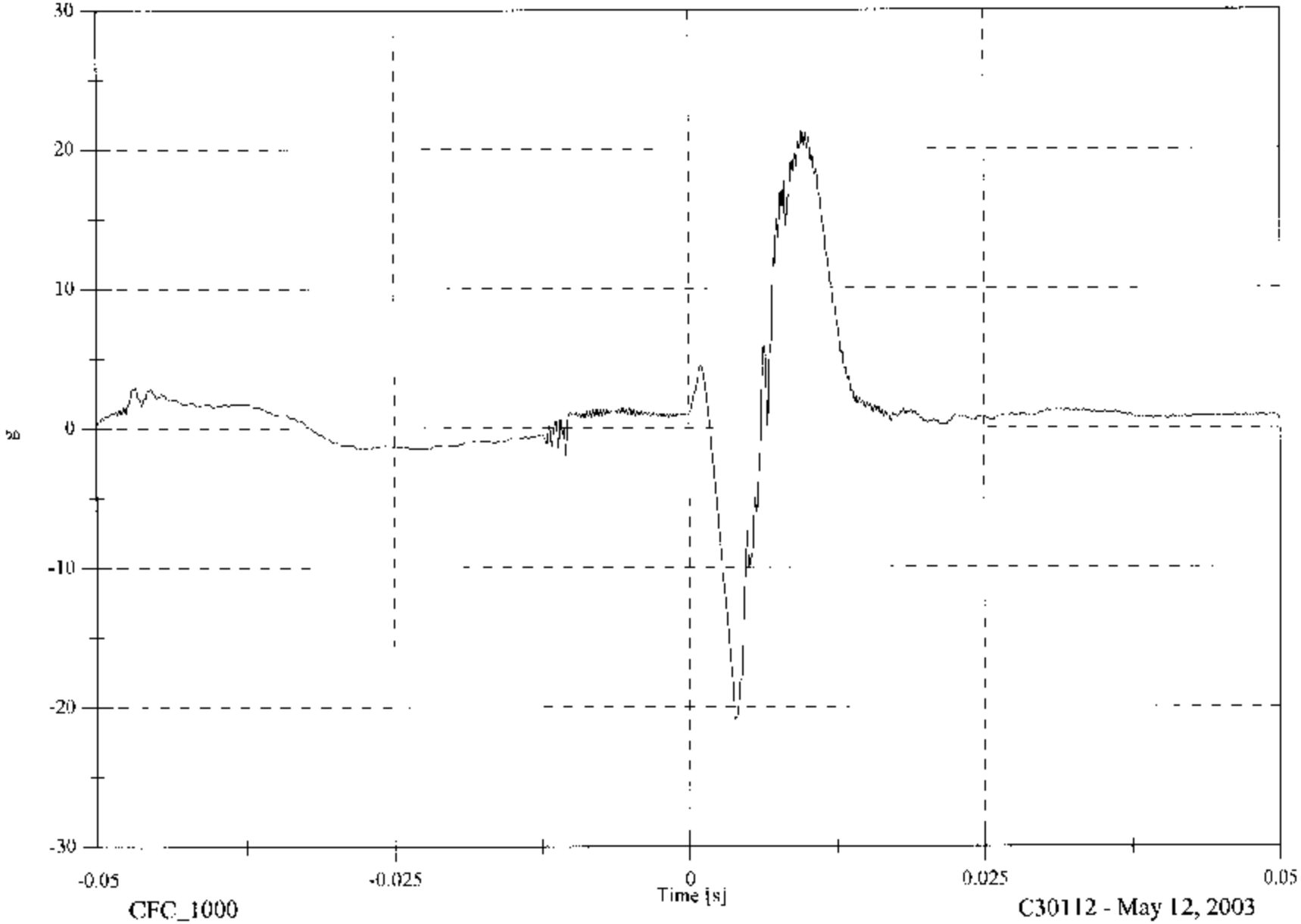
C30112 PASSENGER SIDE RP1 IMPACT PLOT #3

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Z Acceleration

Max: 21.3 [g] at 0.010 [s]

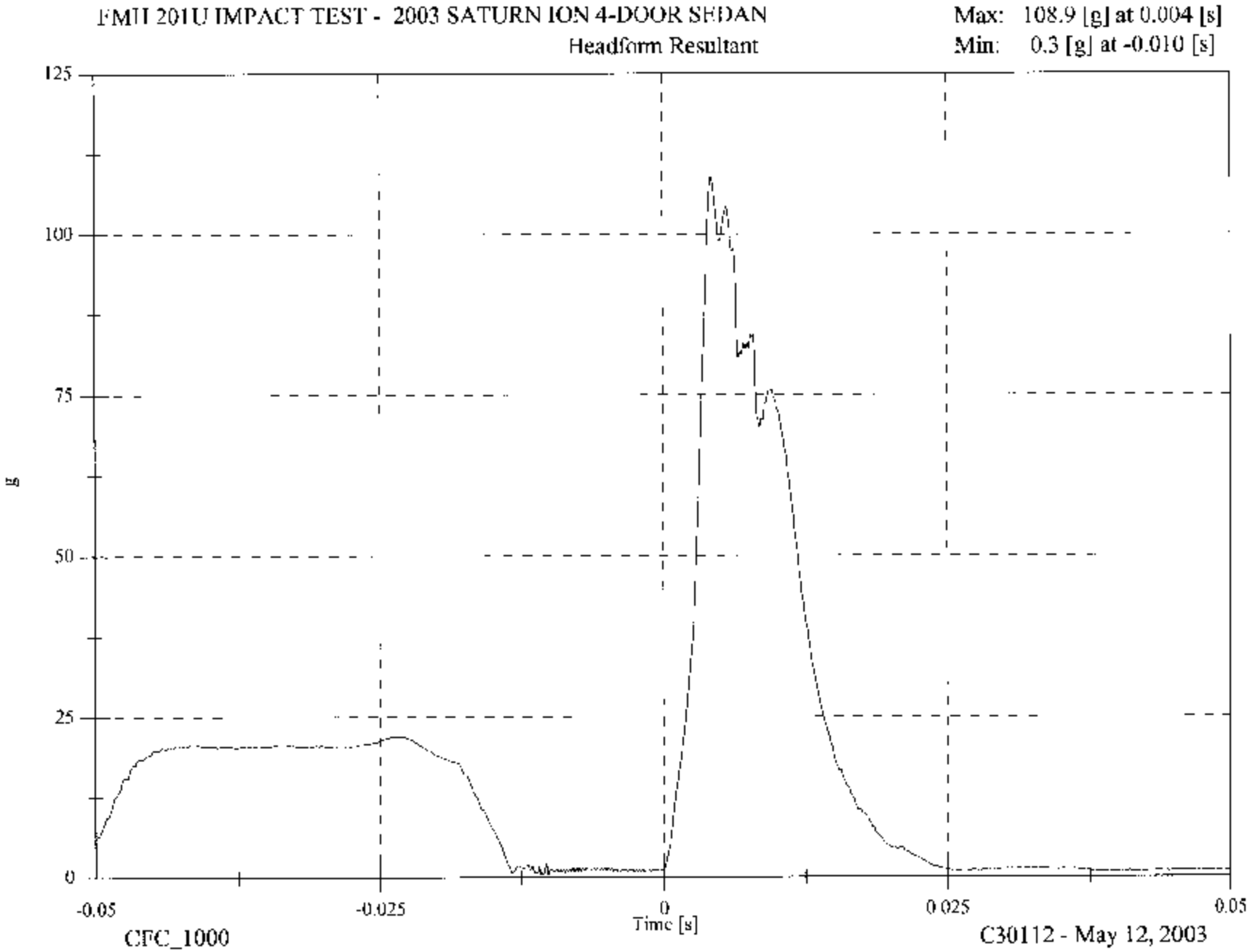
Min: -20.9 [g] at 0.004 [s]



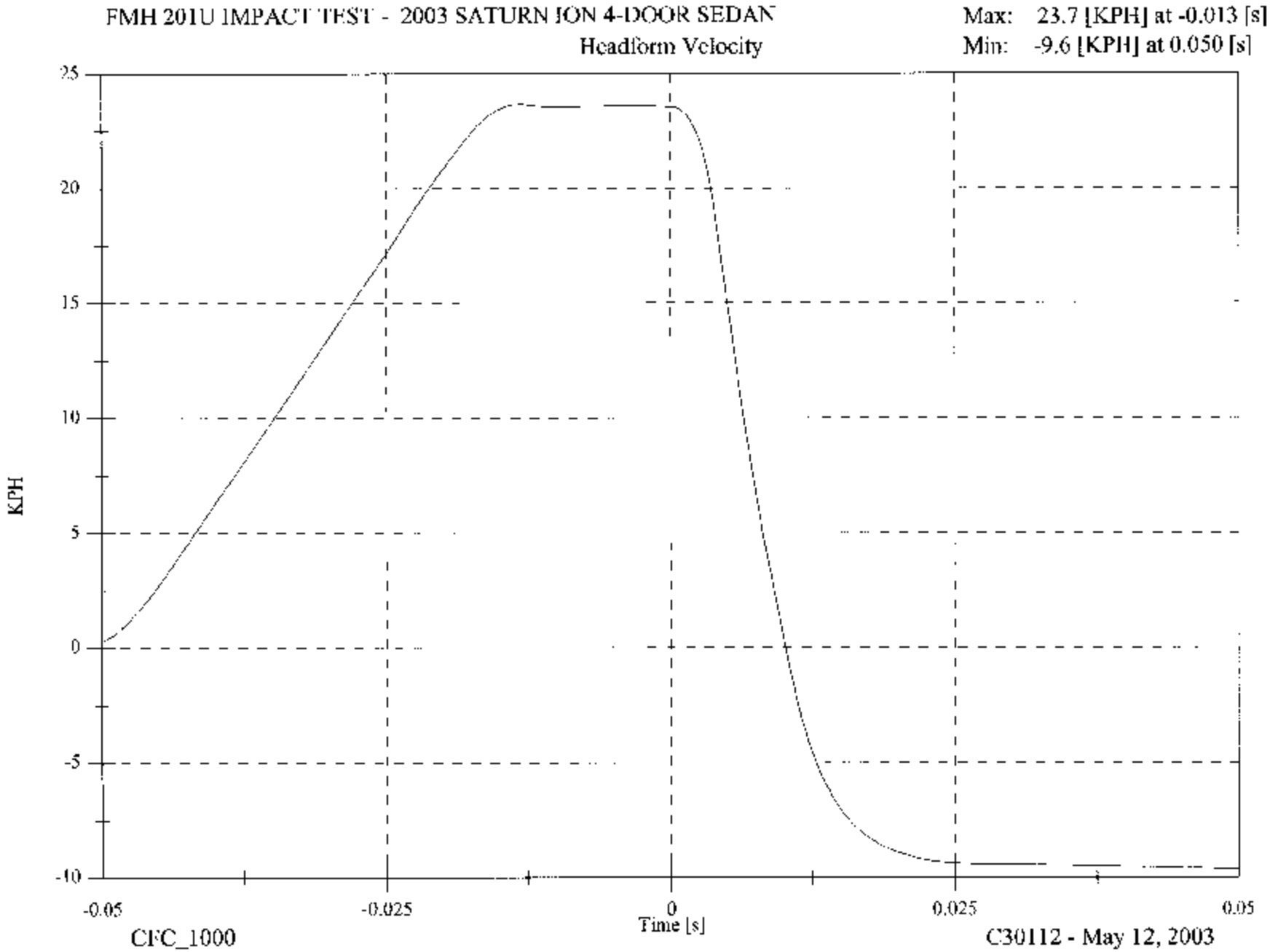
CFC_1000

C30112 - May 12, 2003

C30112 PASSENGER SIDE BPI IMPACT PLOT #4



C30112 PASSENGER SIDE BP1 IMPACT PLOT #5



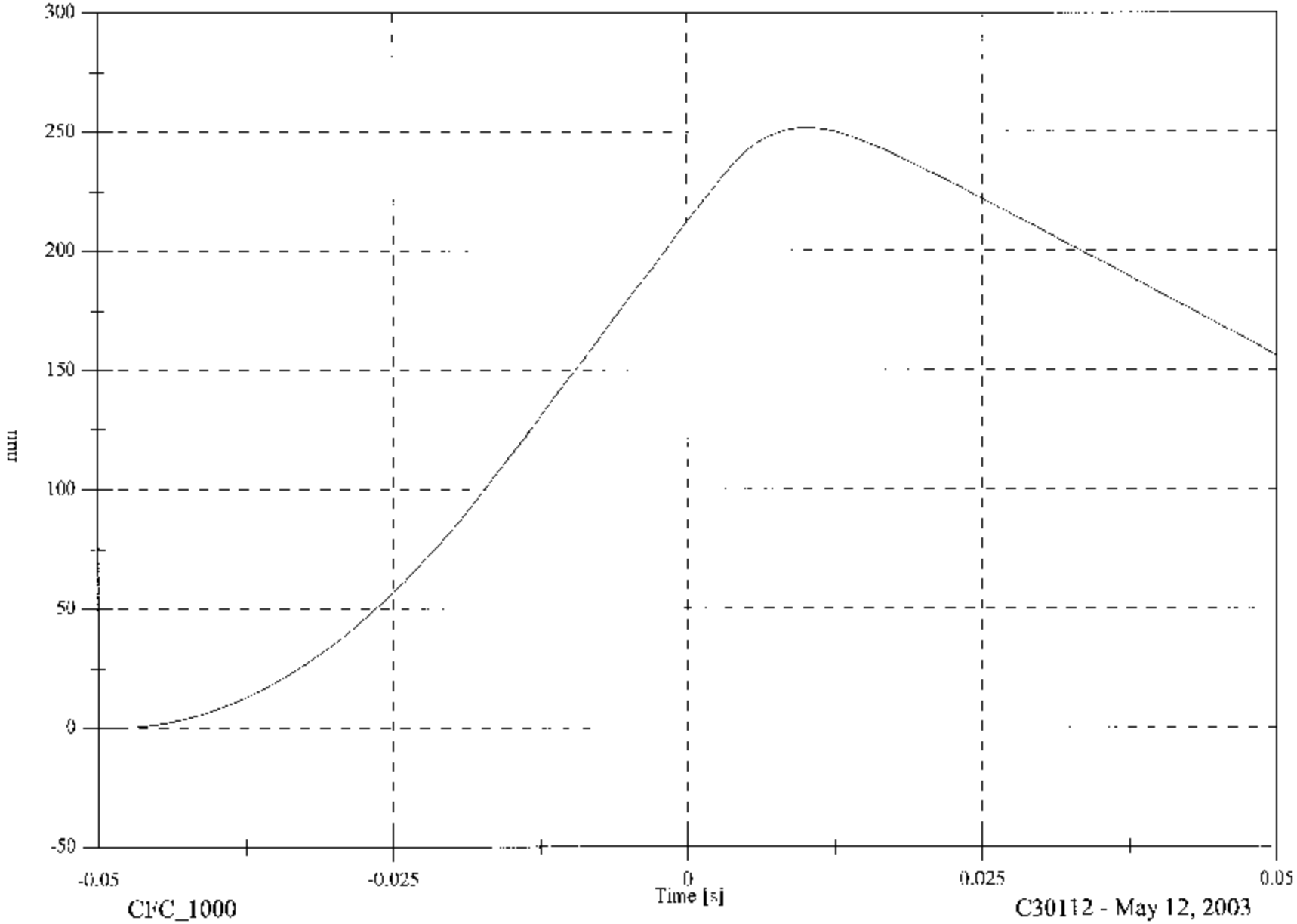
C30112 PASSENGER SIDE BP1 IMPACT PLOT #6

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Displacement

Max: 251.8 [mm] at 0.010 [s]

Min: -0.1 [mm] at -0.050 [s]



CFC_1000

C30112 - May 12, 2003

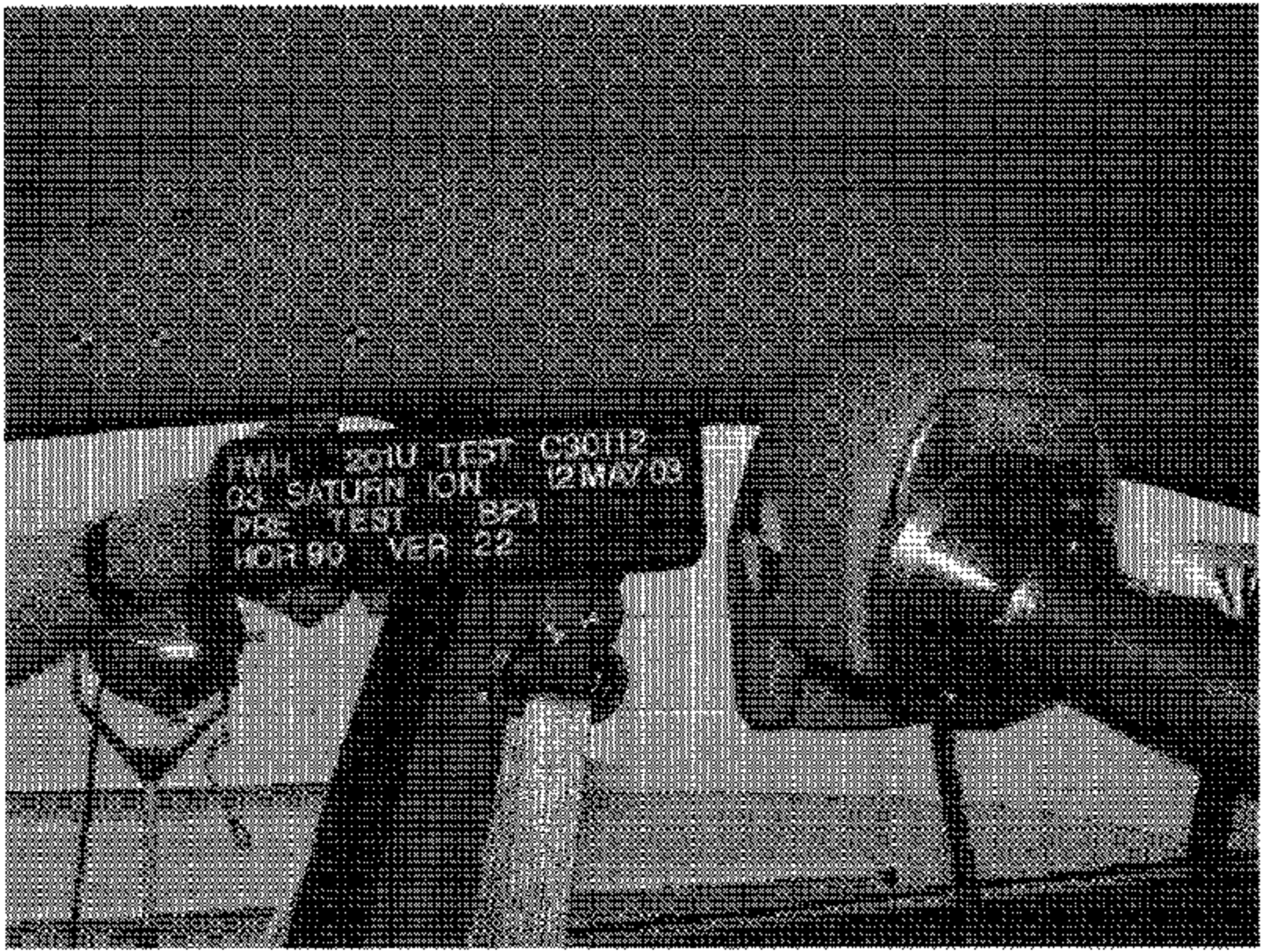


Figure : PRE-TEST BP1

Figure 1: PRIOR ART

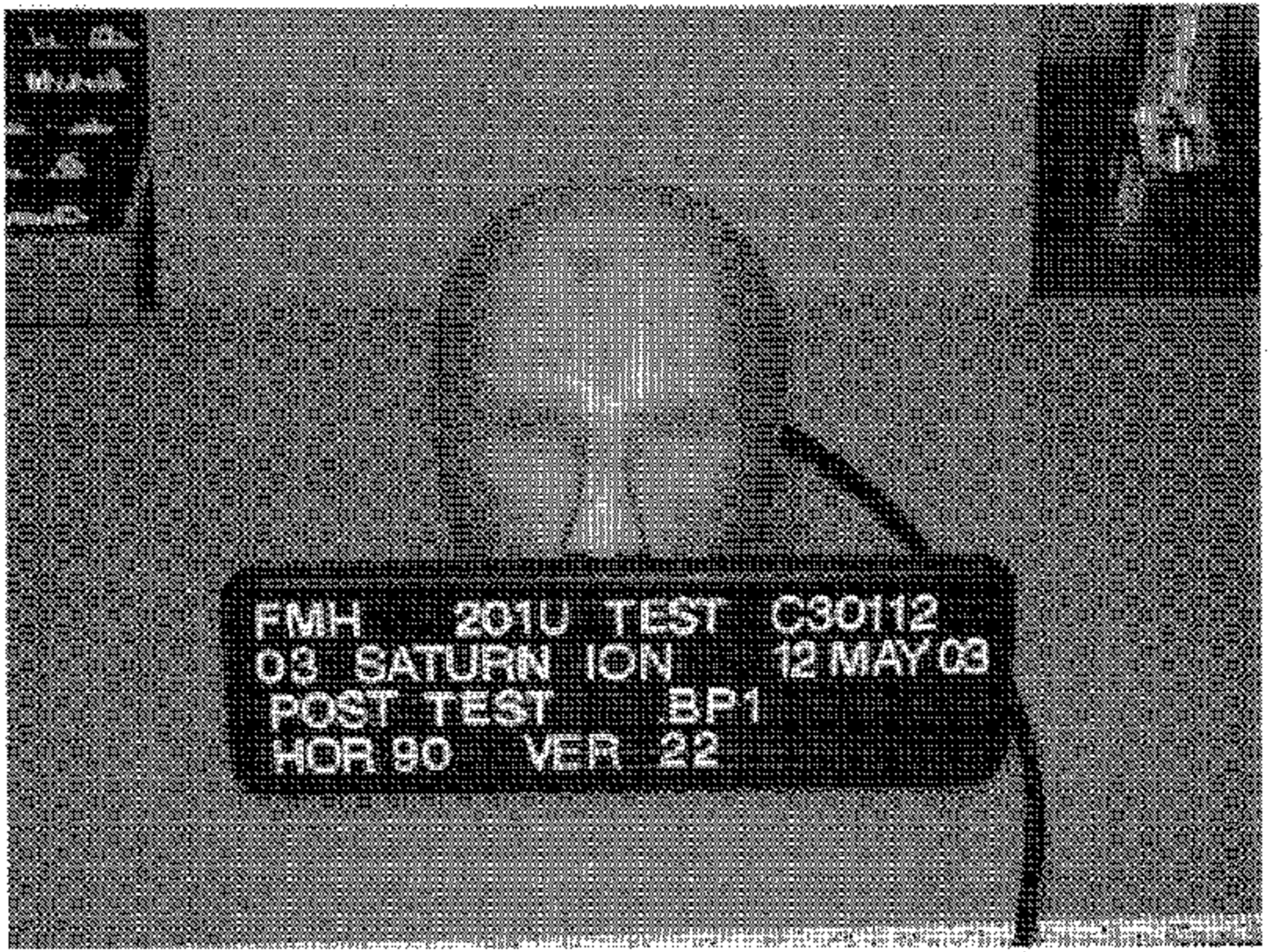


Figure : BP1 HEADFORM

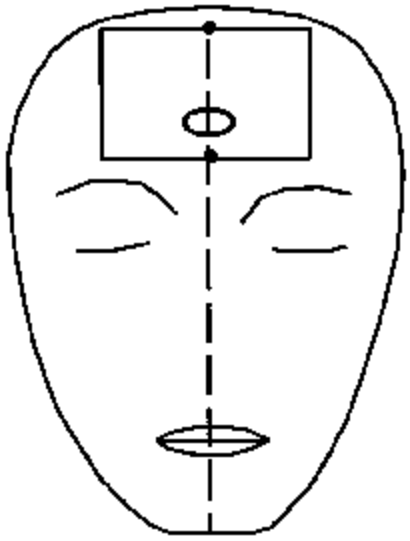
Year/Make/Model/Body Style:	2003 Saturn Ion 4-door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

Test Number:	6	Test Date:	MAY 12, 2003
Target Location:	SIDE RAIL	Target Code:	SR2A
Horizontal Impact Angle:	90 °	Vertical Impact Angle:	39 °
Ambient Temperature:	22 °C	Time of Impact:	15:15
Headform Number:	0062		

Impact Point:

Description:

Description:	From lower midpoint				
On centerline	21	mm up			
On centerline	0	-	mm right	-	mm left



Free Motion HIC:	476.4	HIC(d):	525.8		
Impact Velocity (kph):	23.42	HICT1	3.9 msec	HICT2	13.2 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112 - SR2

FMH Headform 0062

Test Date: May 12, 2003

Location: SR2A

Work File: SR2A

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 32 %

Velocity at Impact: 23.42 KPH

Free Flight Distance: 211.39 mm

HICd: 525.8

HIC (36ms): 476.4

t1: 3.9 msec

t2: 13.2 msec

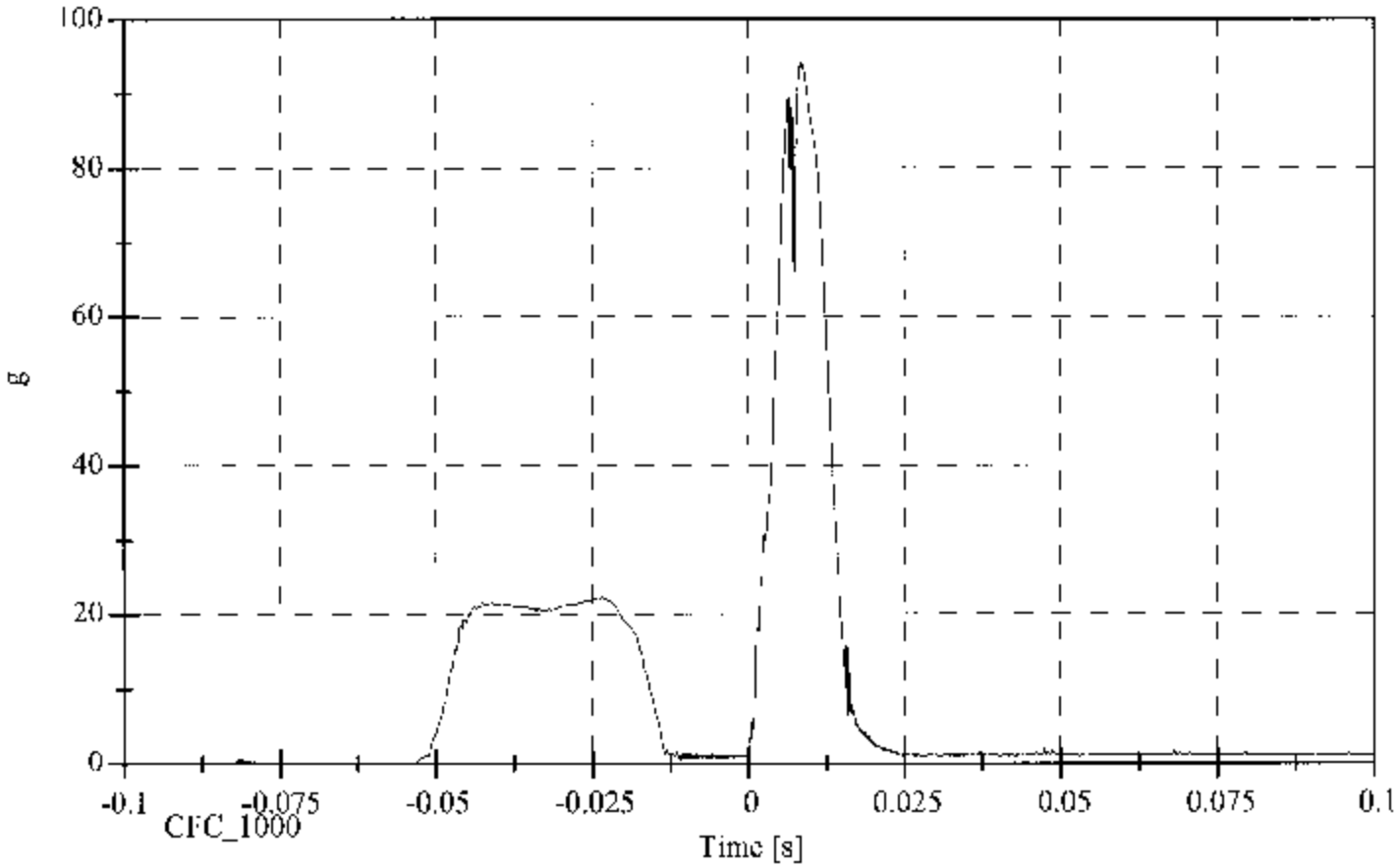
Duration: 9.2 msec

Average Acceleration: 8.4 g

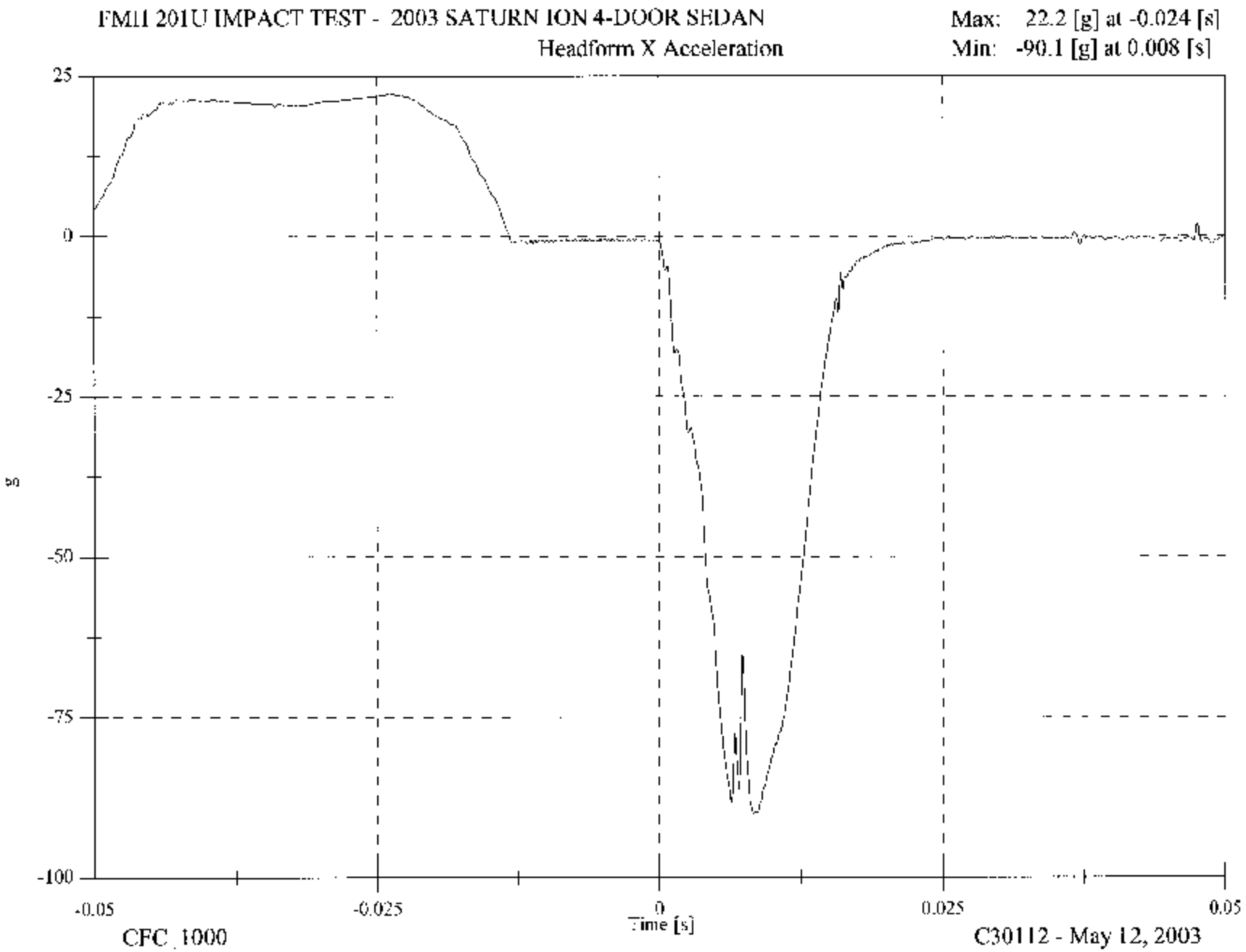
FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Resultant

Max: 94.1 [g] at 0.009 [s]

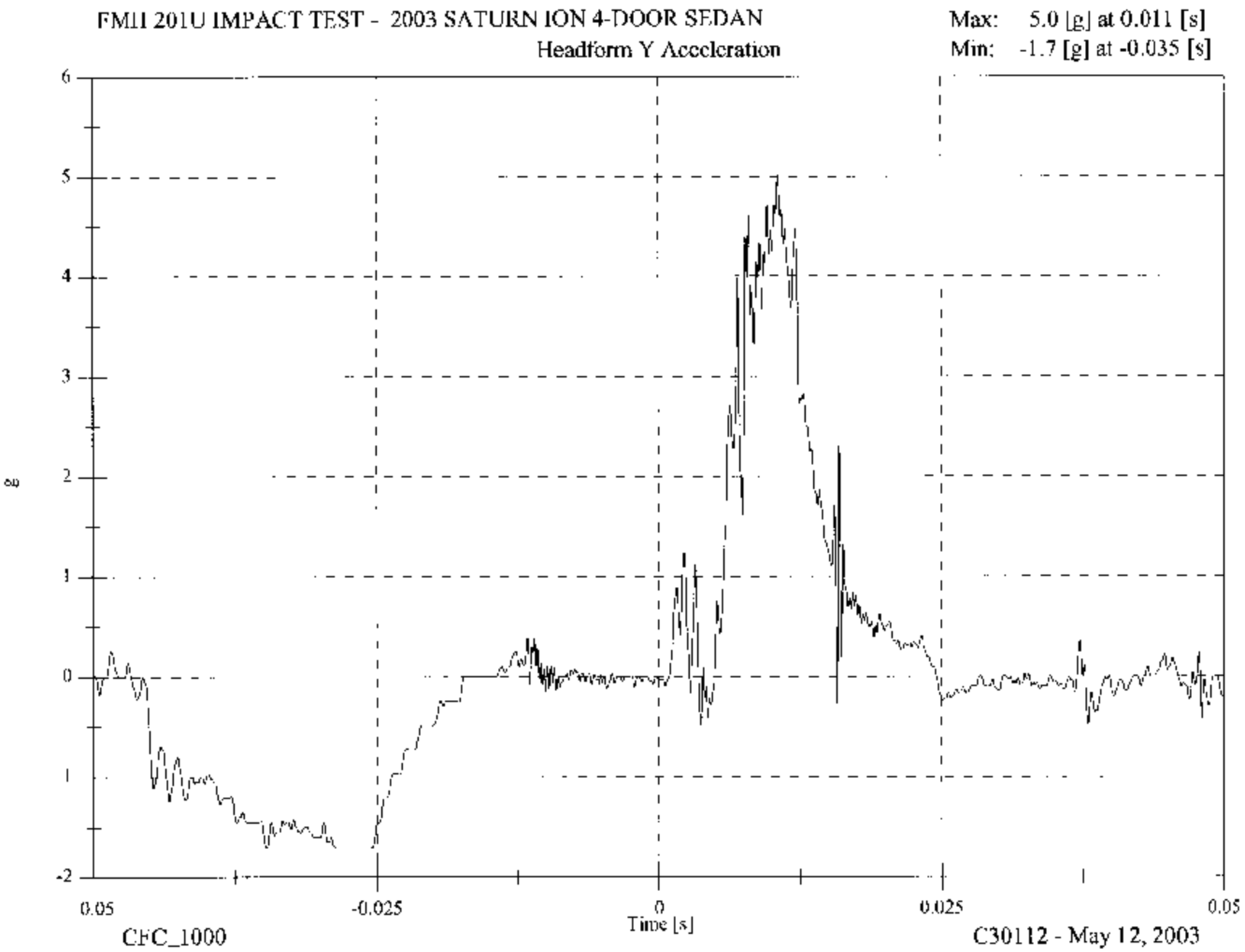
Min: 0.0 [g] at -0.058 [s]



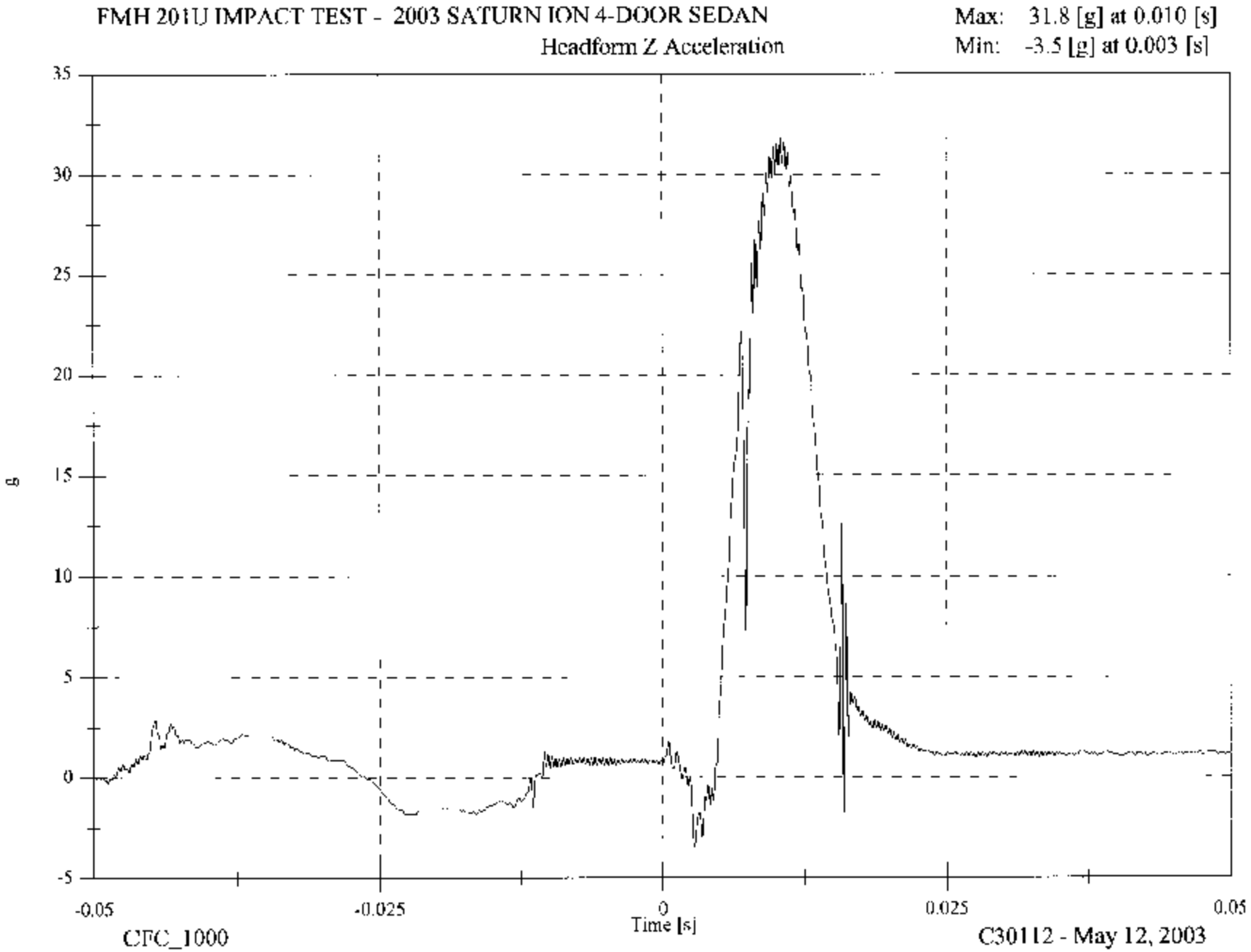
C30112 PASSENGER SIDE SR2A IMPACT PLOT #1



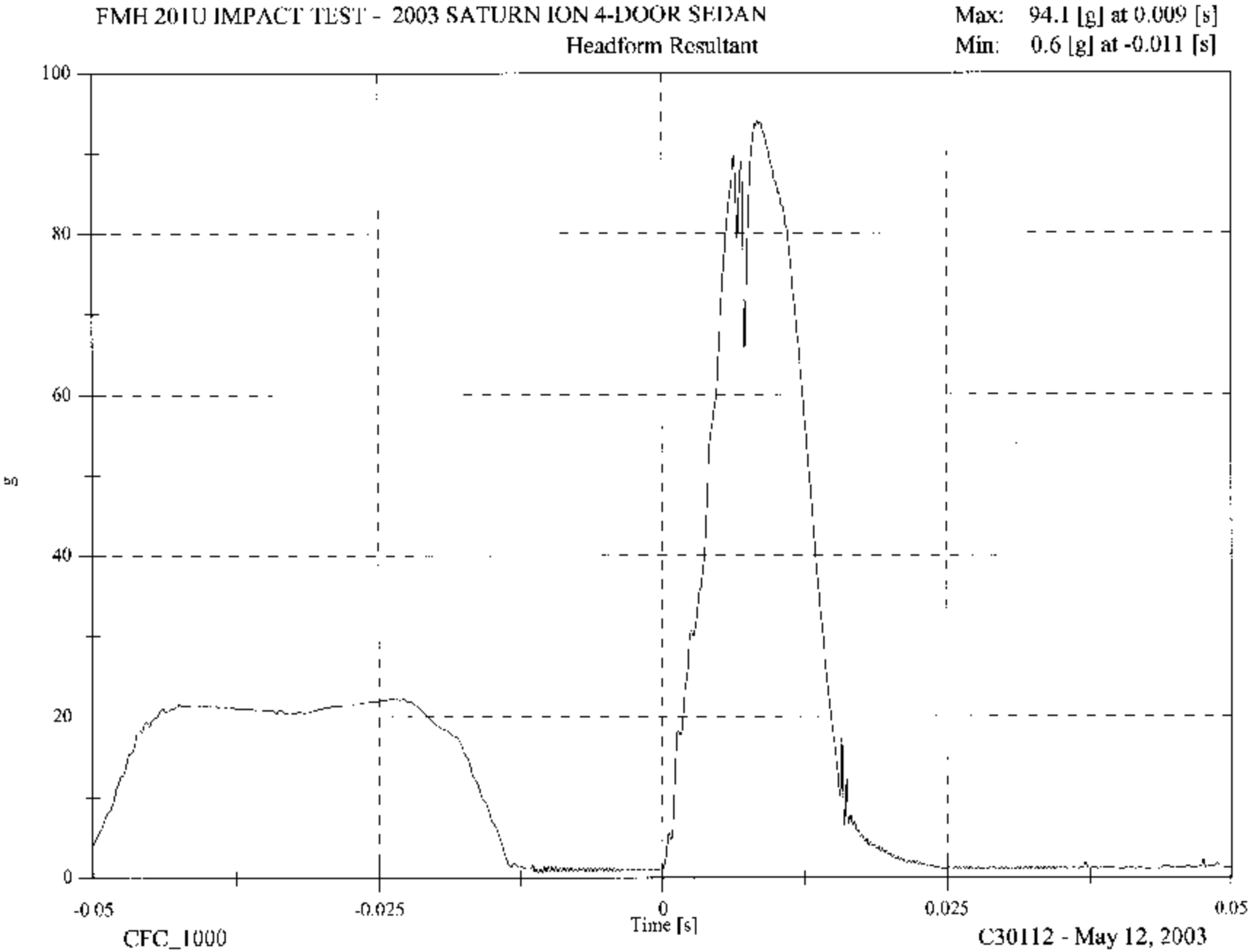
C30112 PASSENGER SIDE SRZA IMPACT PLOT #2



C30112 PASSENGER SIDE SR2A IMPACT PLOT #3



C30112 PASSENGER SIDE SR2A IMPACT PLOT #4



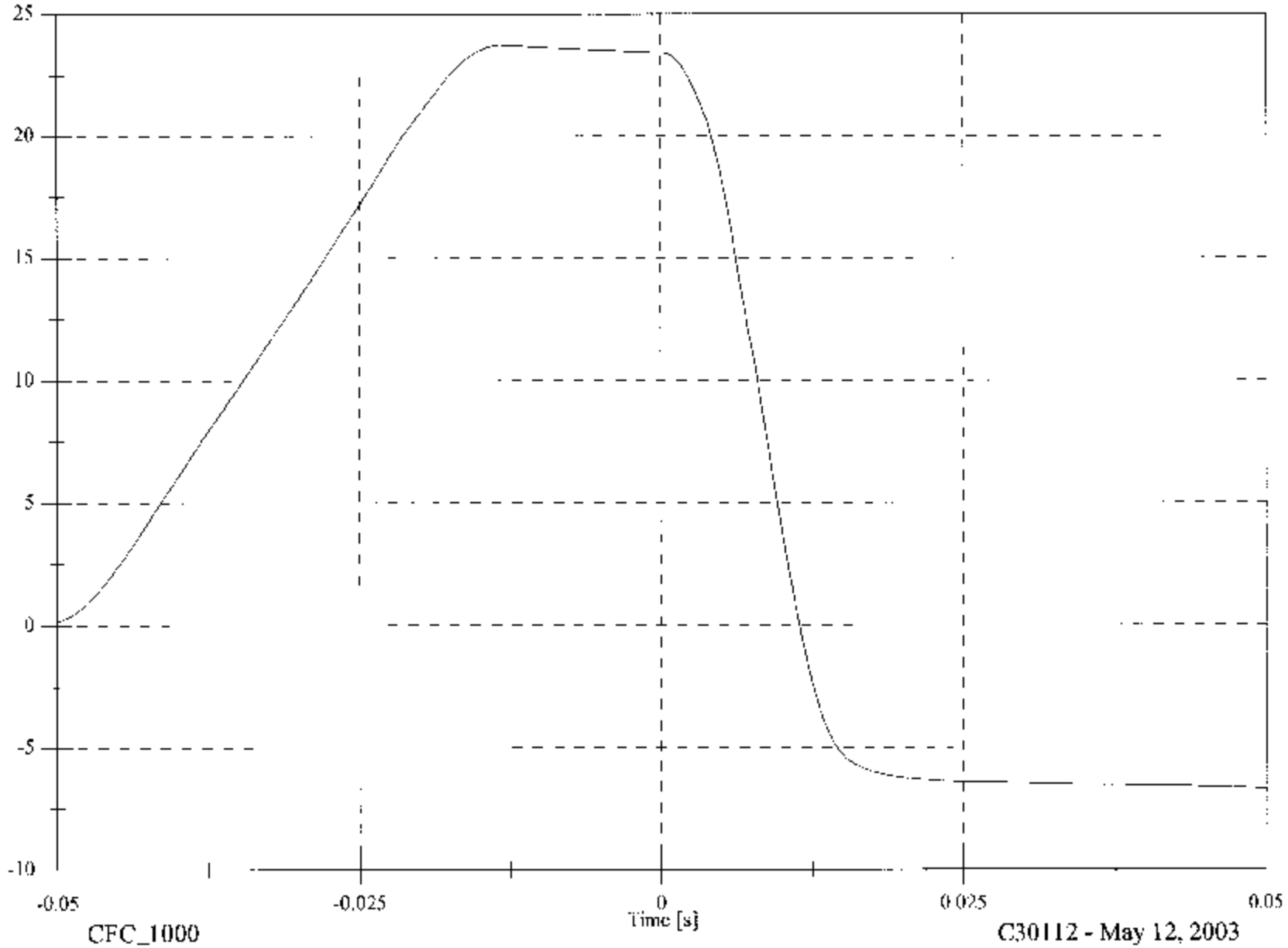
C30112 PASSENGER SIDE SR2A IMPACT PLOT #5

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Velocity

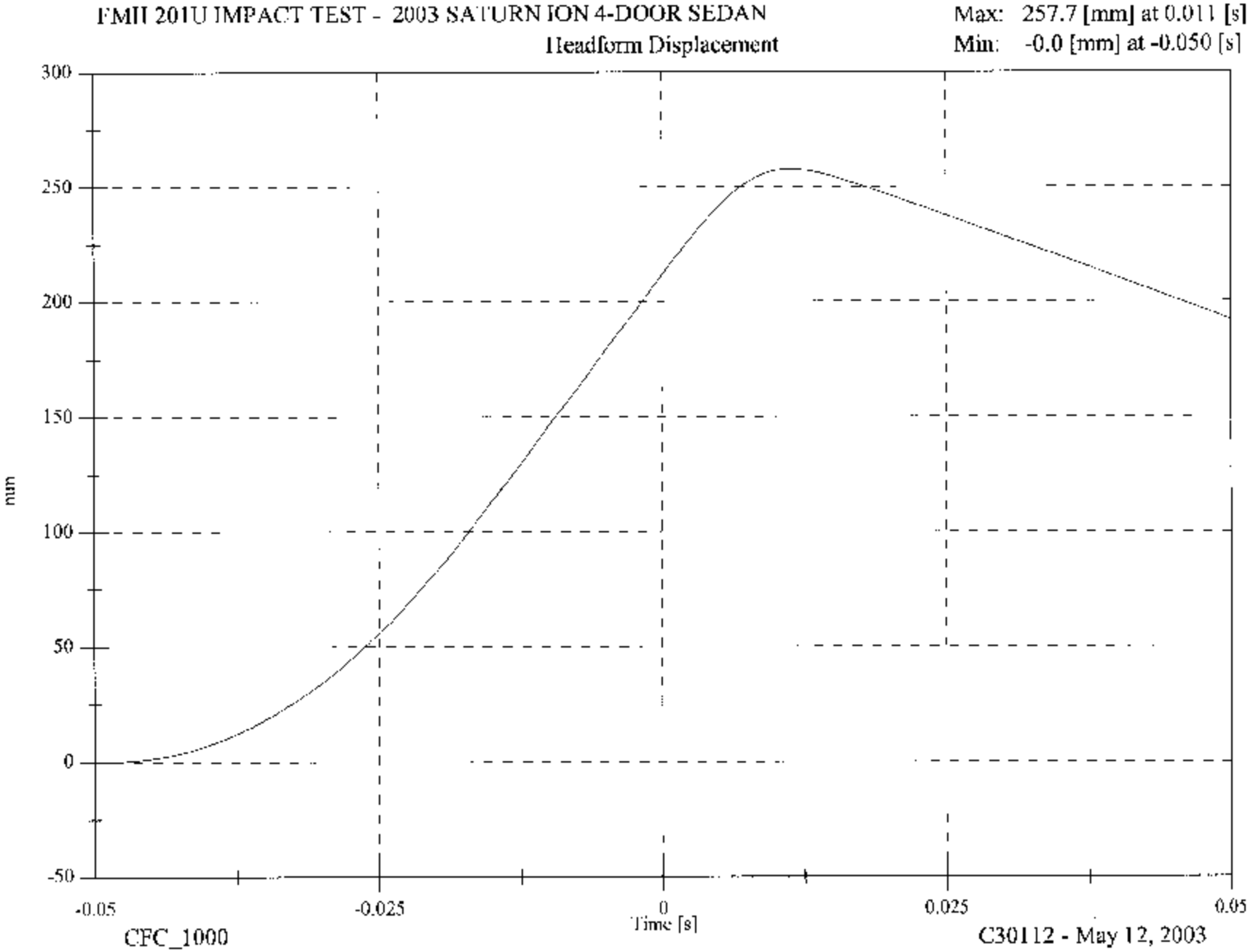
Max: 23.7 [KPH] at -0.013 [s]

Min: -6.7 [KPH] at 0.050 [s]



CFC_1000

C30112 - May 12, 2003



C30112 PASSENGER SIDE SR2A IMPACT PLOT #6

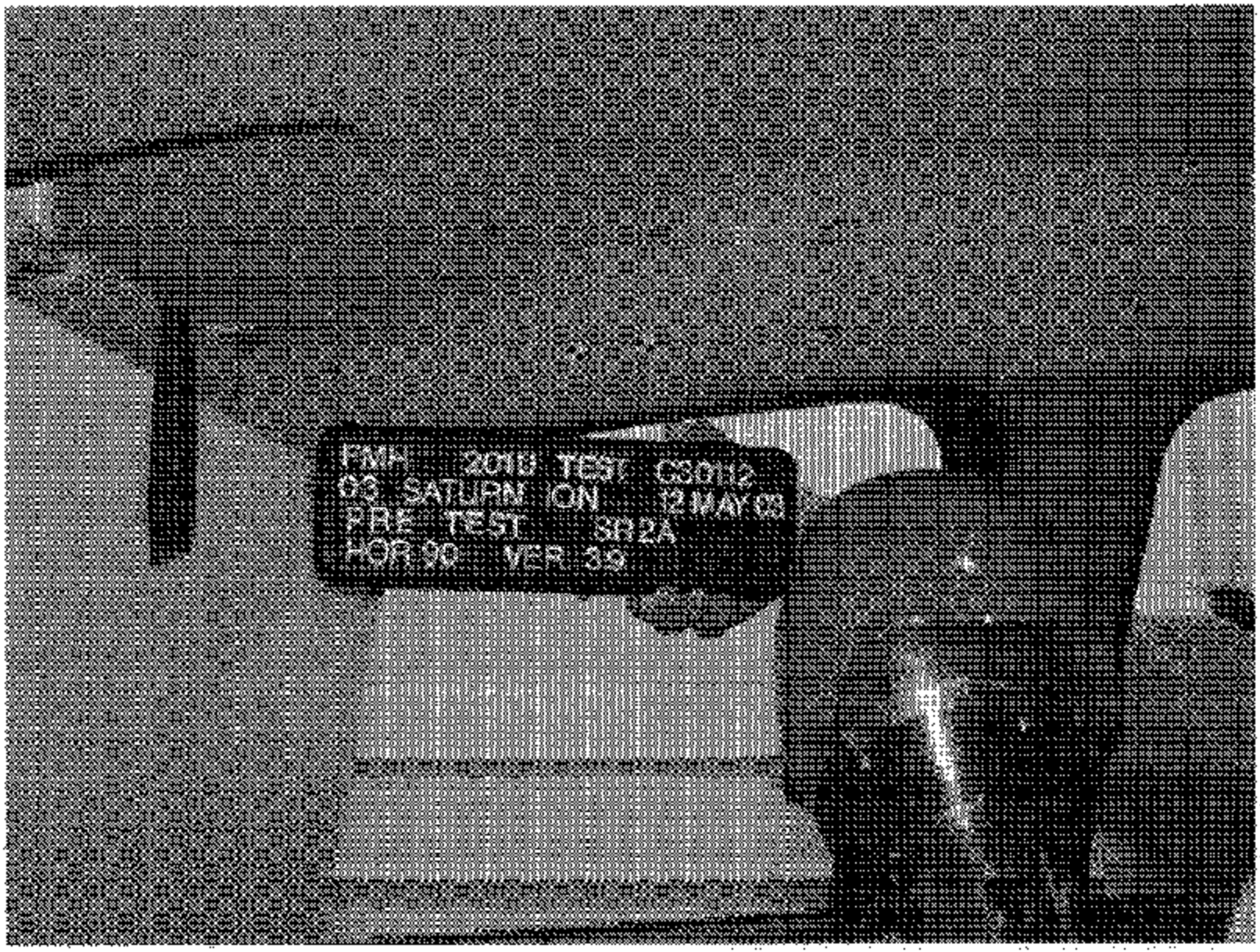


Figure : PRE-TEST SR2A

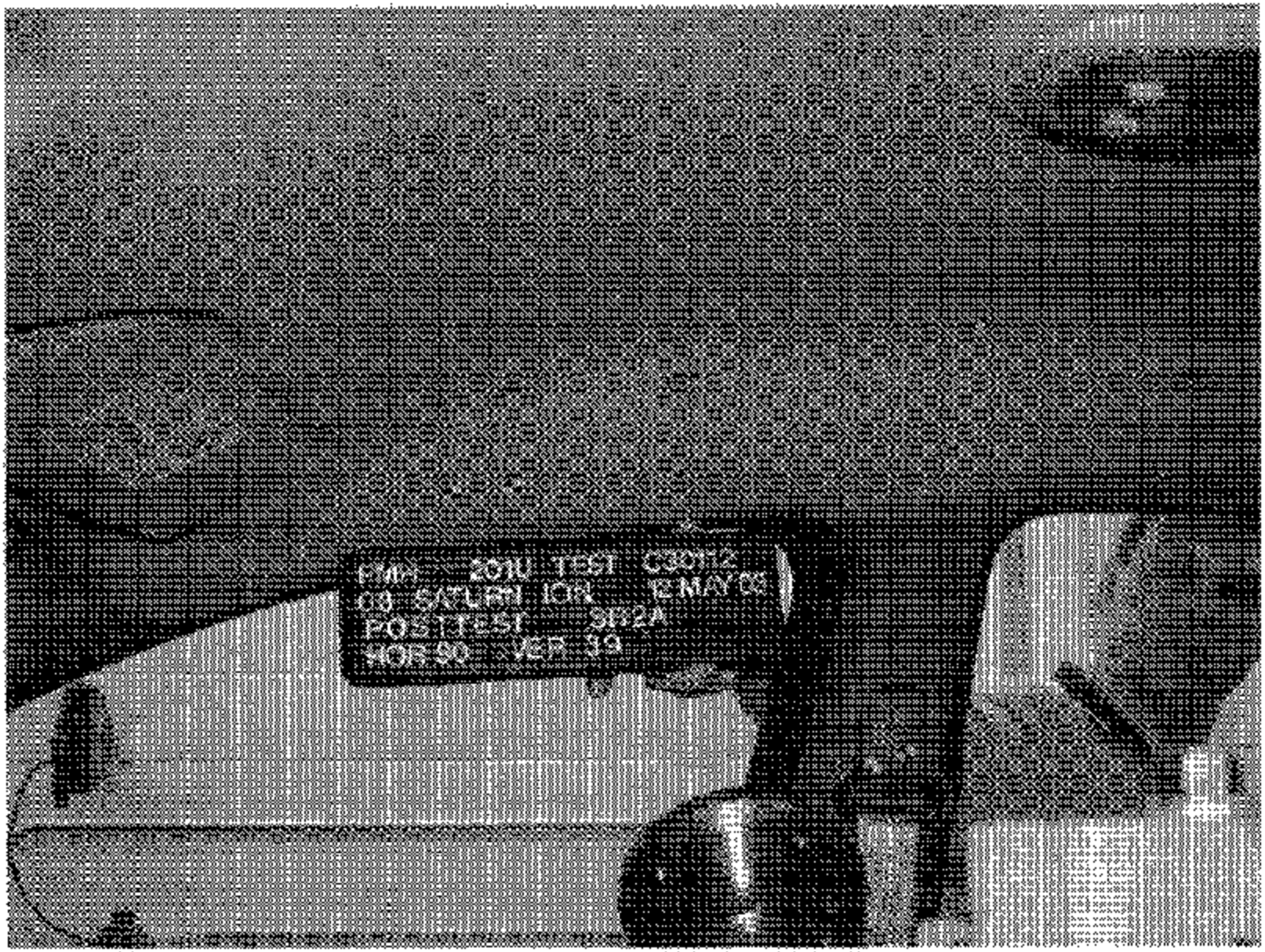


Figure : POST-TEST SR2A

Figure : SR2A HEADFORM

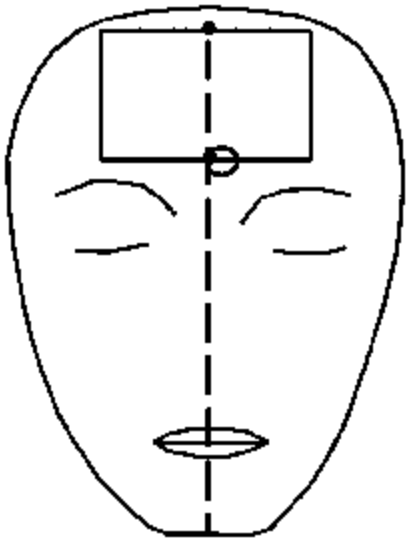
Year/Make/Model/Body Style:	2003 Saturn Ion 4-door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

Test Number:	7	Test Date:	MAY 13, 2003
Target Location:	B-PILLAR	Target Code:	BP2
Horizontal Impact Angle:	270 °	Vertical Impact Angle:	0 °
Ambient Temperature:	22 °C	Time of Impact:	9:50
Headform Number:	1255		

Impact Point:

Description:

Description:	From lower midpoint				
On centerline	0	mm up			
On centerline	6	-	mm right	x	mm left



Free Motion HIC:	583.8	HIC(d):	606.9		
Impact Velocity (kph):	23.70	HICT1	3.8 msec	HICT2	11.1 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112 - BP2

FMH Headform 1255

Test Date: May 13, 2003

Location: BP2

Work File: BP2

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 36 %

Velocity at Impact: 23.70 KPH

Free Flight Distance: 209.66 mm

HICd: 606.9

HIC (36ms): 583.8

t1: 3.8 msec

t2: 11.1 msec

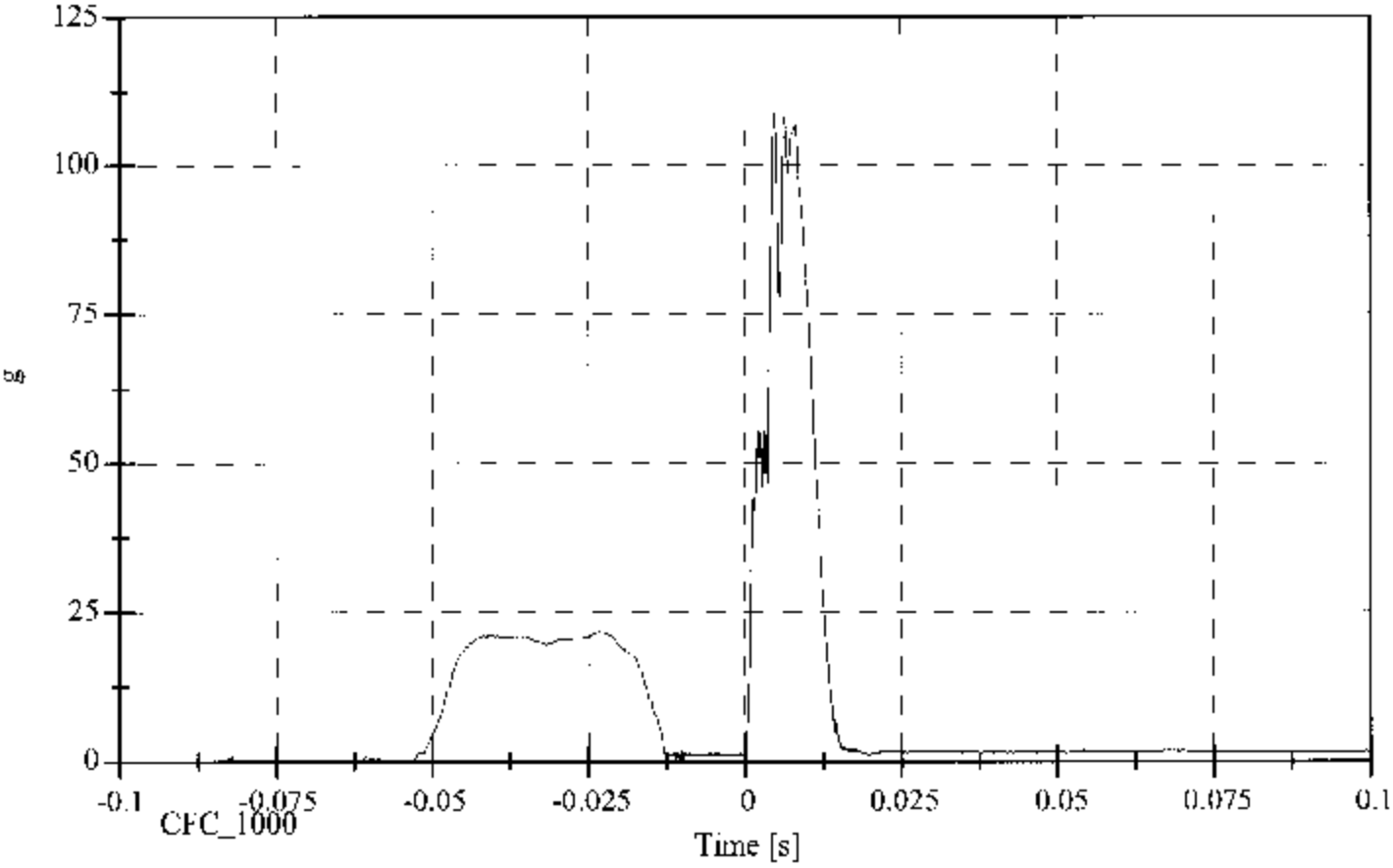
Duration: 7.3 msec

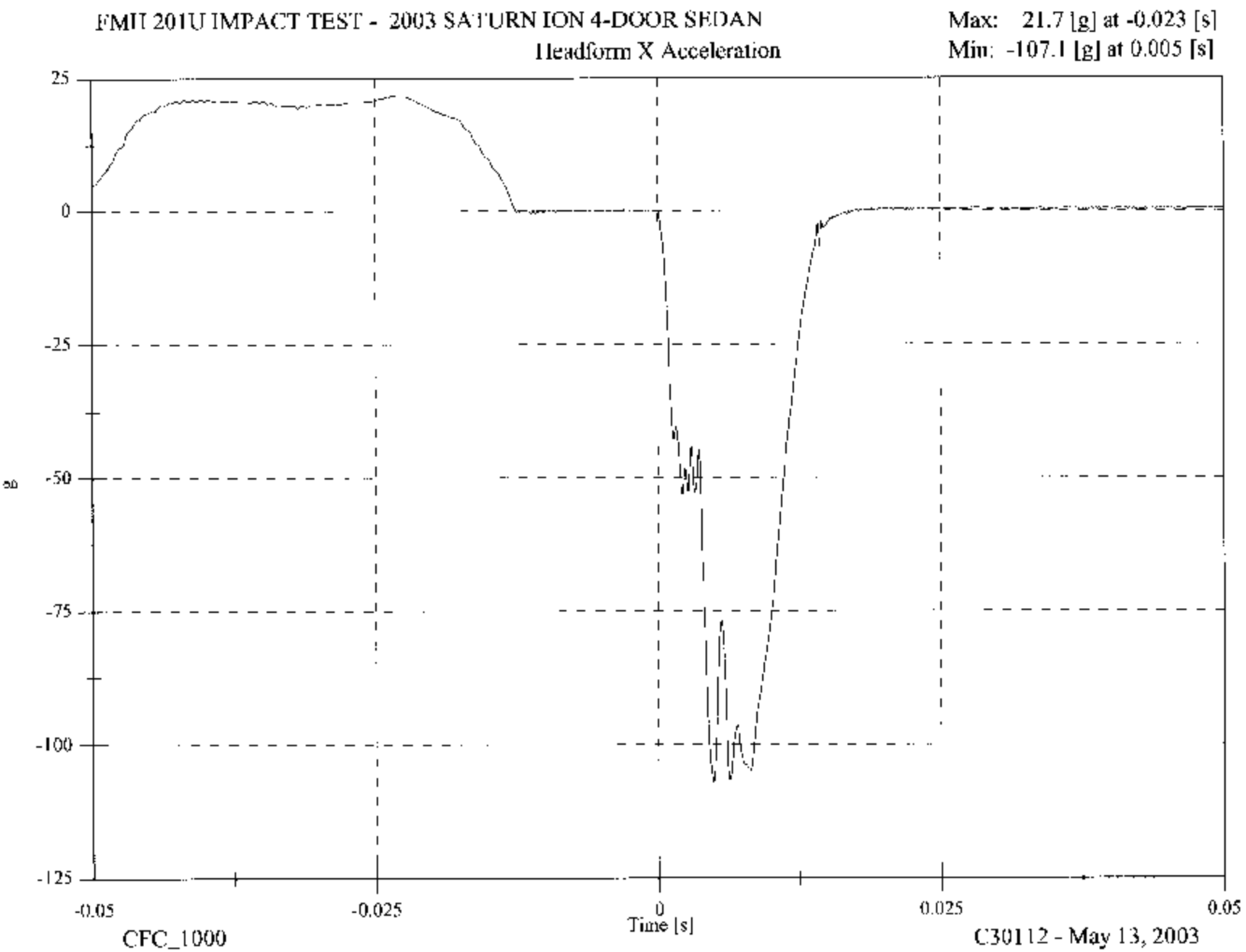
Average Acceleration: 8.6 g

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Resultant

Max: 109.0 [g] at 0.005 [s]

Min: 0.0 [g] at -0.095 [s]





C30112 DRIVER SIDE BP2 IMPACT PLOT #1

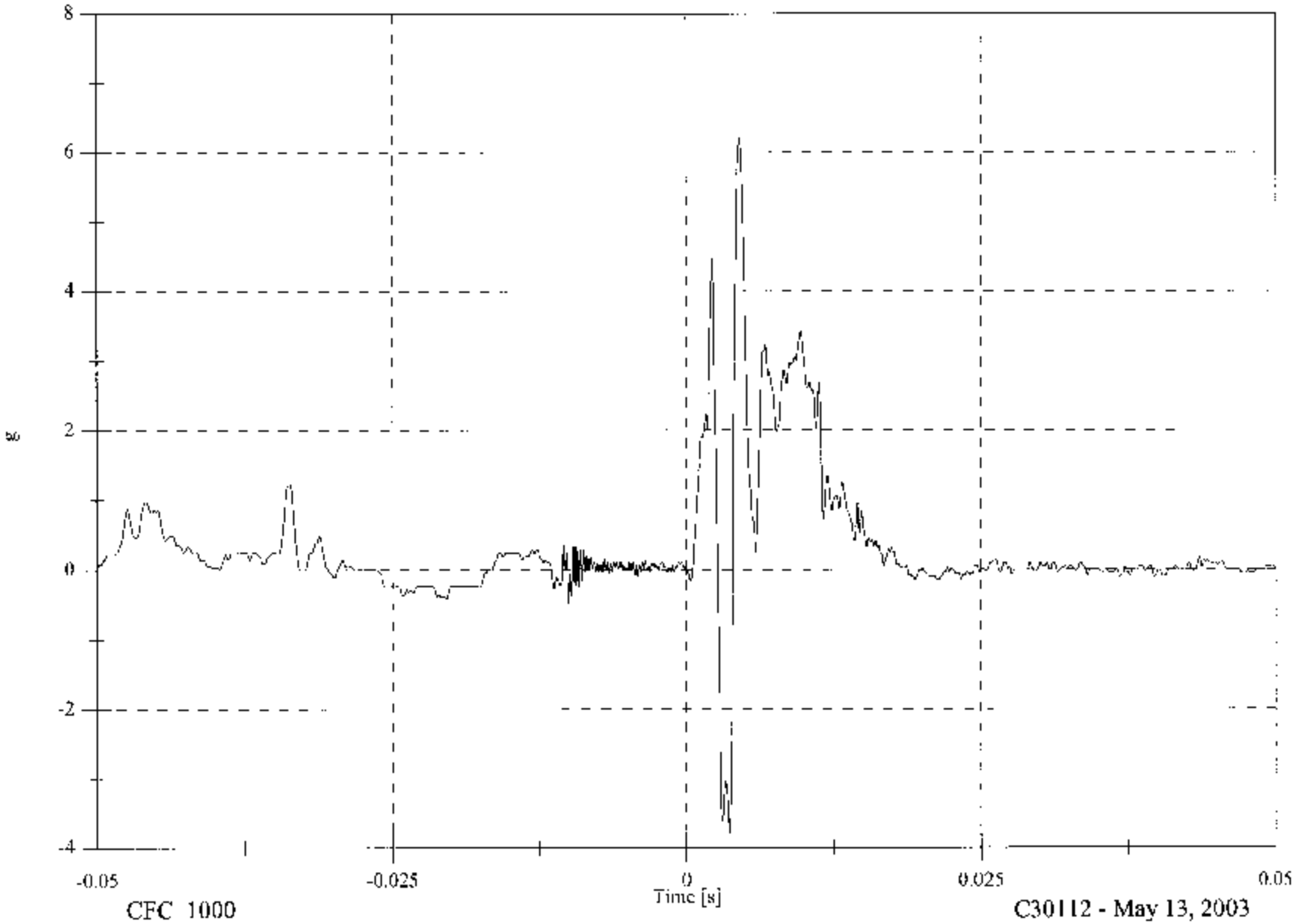
C30112 DRIVER SIDE BP2 IMPACT PLOT #2

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Y Acceleration

Max: 6.2 [g] at 0.005 [s]

Min: -3.8 [g] at 0.004 [s]



CFC 1000

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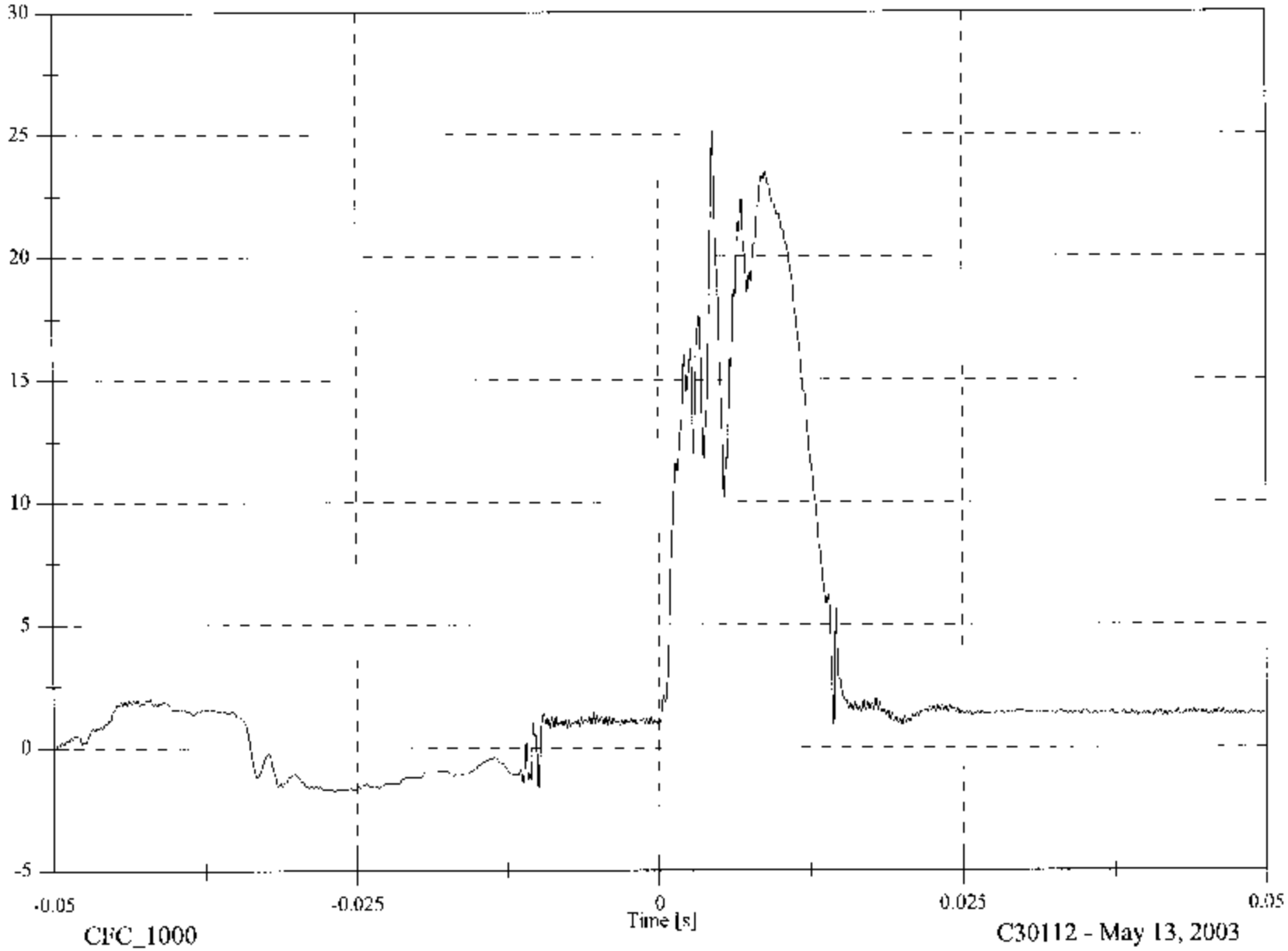
C30112 DRIVER SIDE BP2 IMPACT PLOT #3

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Z Acceleration

Max: 25.2 [g] at 0.004 [s]

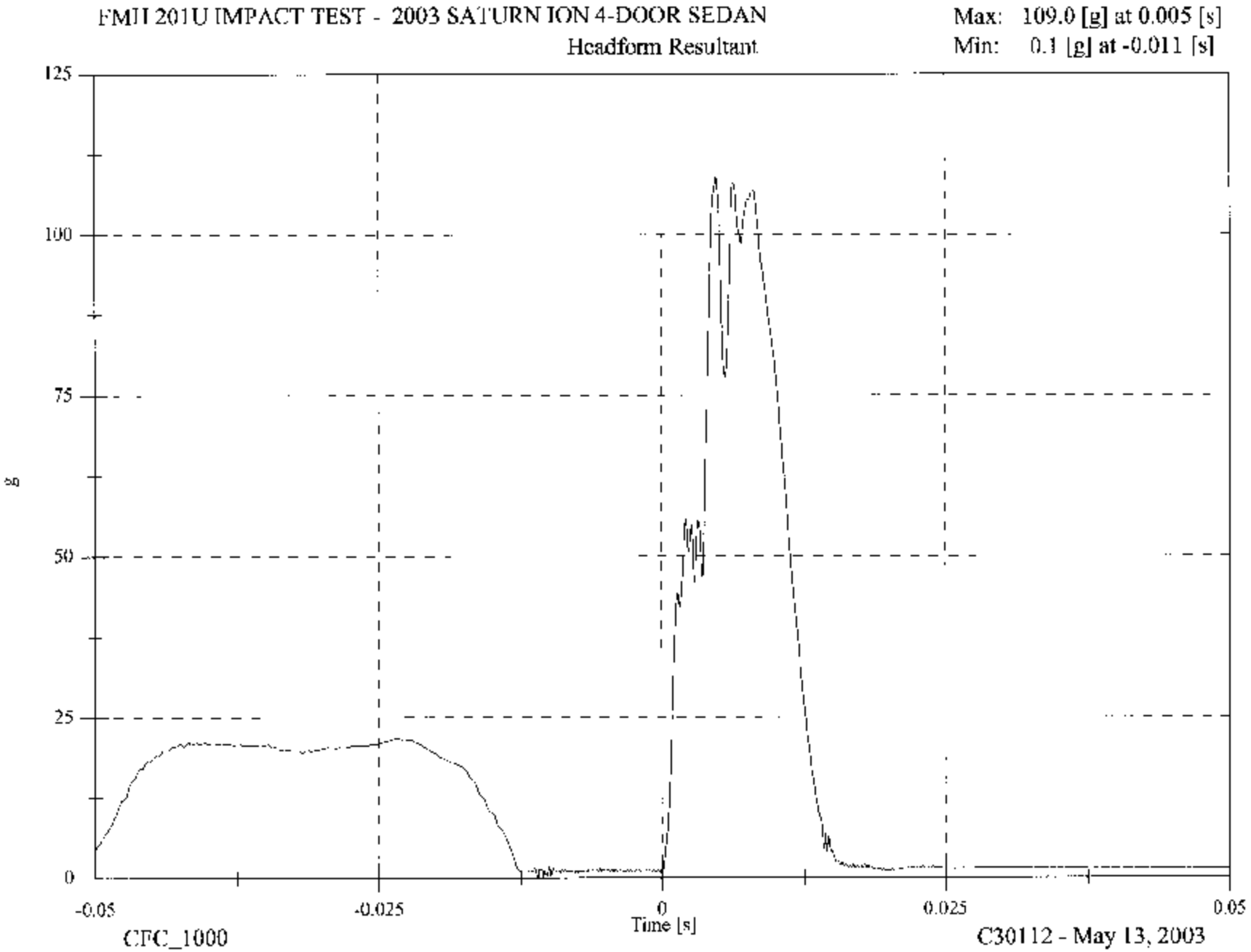
Min: -1.8 [g] at -0.027 [s]



CFC_1000

C30112 - May 13, 2003

C30112 DRIVER SIDE BP2 IMPACT PLOT #4



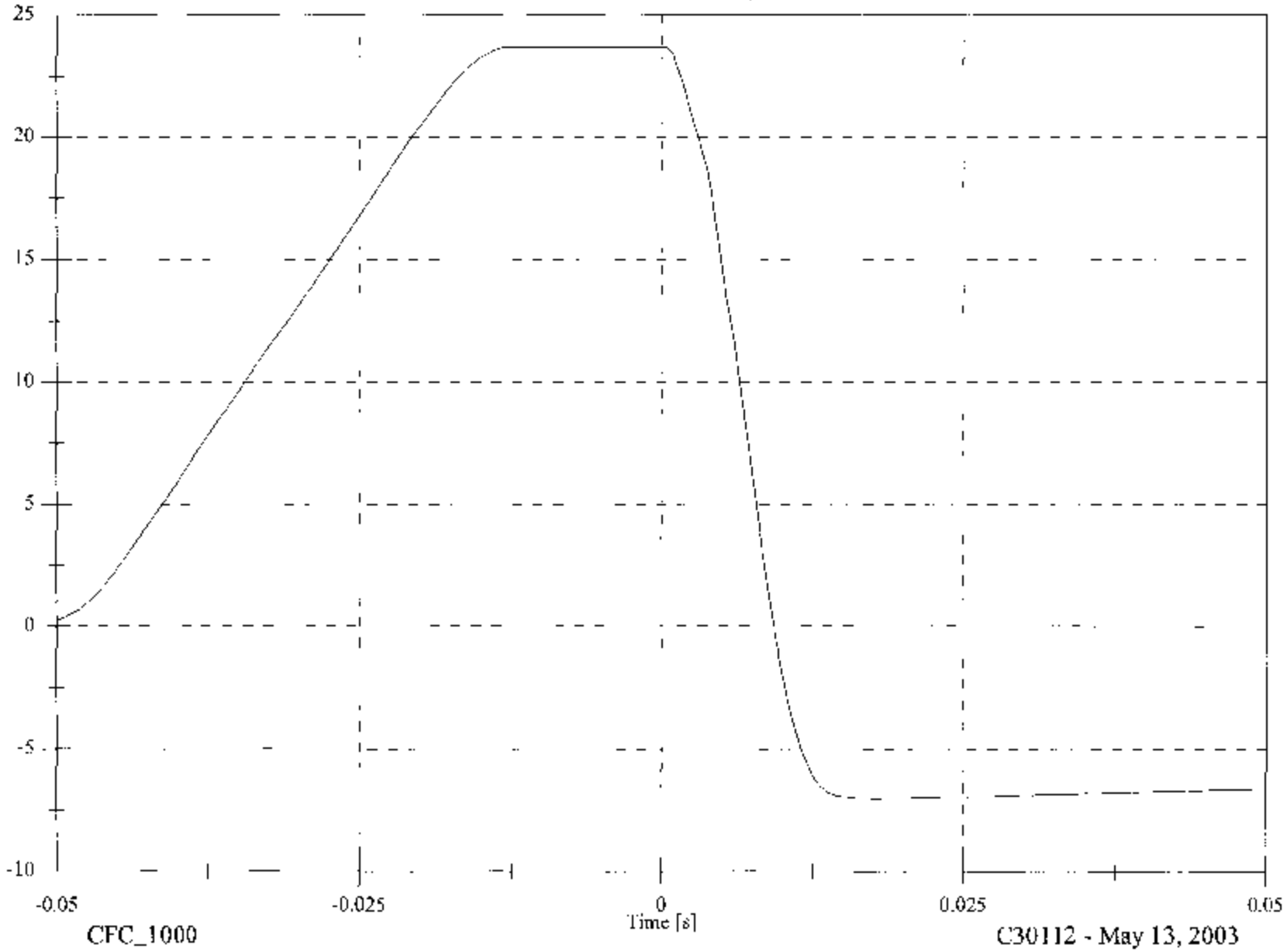
C30112 DRIVER SIDE FP2 IMPACT PLOT #5

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Velocity

Max: 23.7 [KPH] at 0.000 [s]

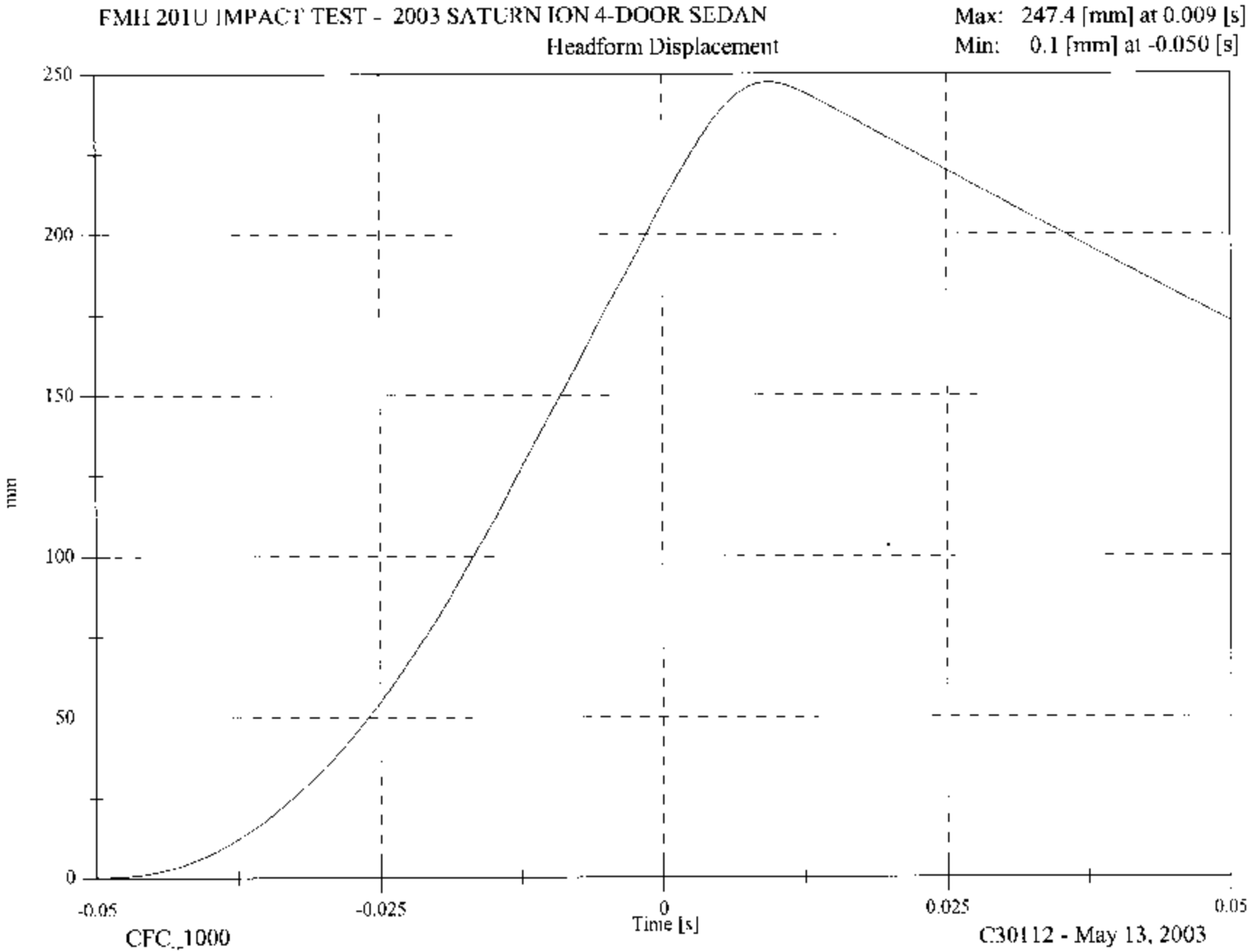
Min: -7.0 [KPH] at 0.018 [s]



CFC_1000

C30112 - May 13, 2003

C30112 DRIVER SIDE BP2 IMPACT PLOT #6



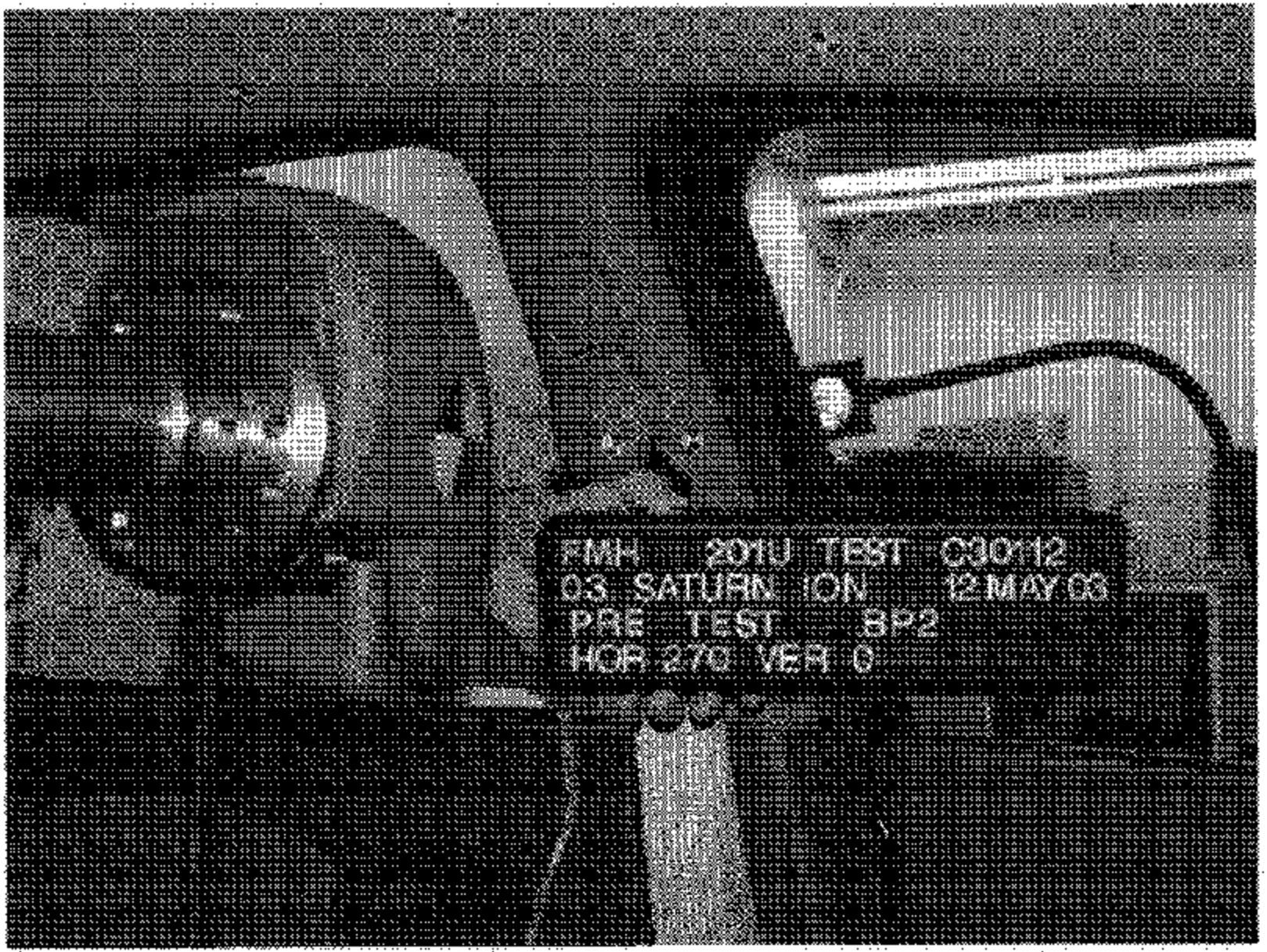


Figure : PRE-TEST BP2

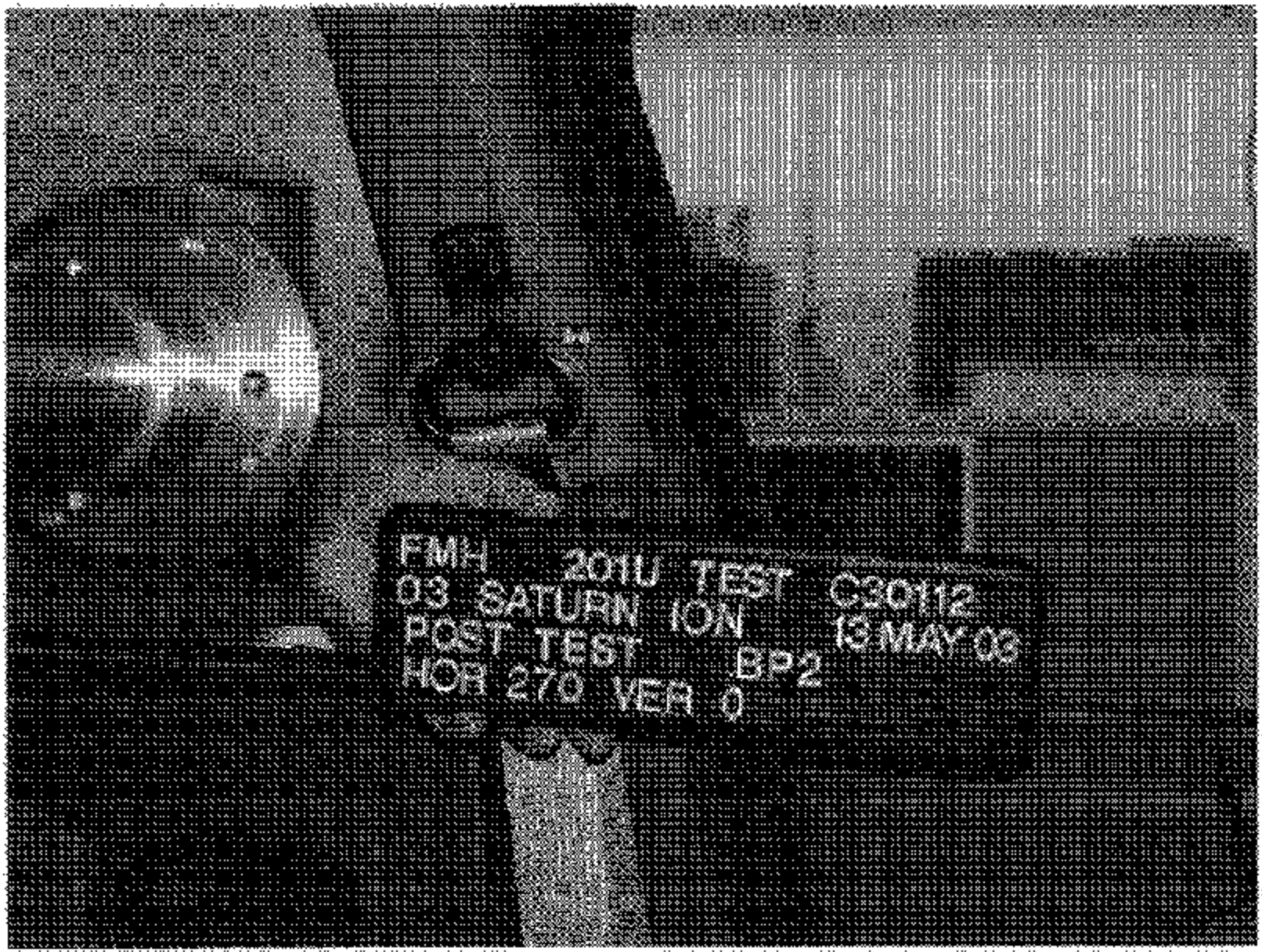


Figure : POST-TEST BP2

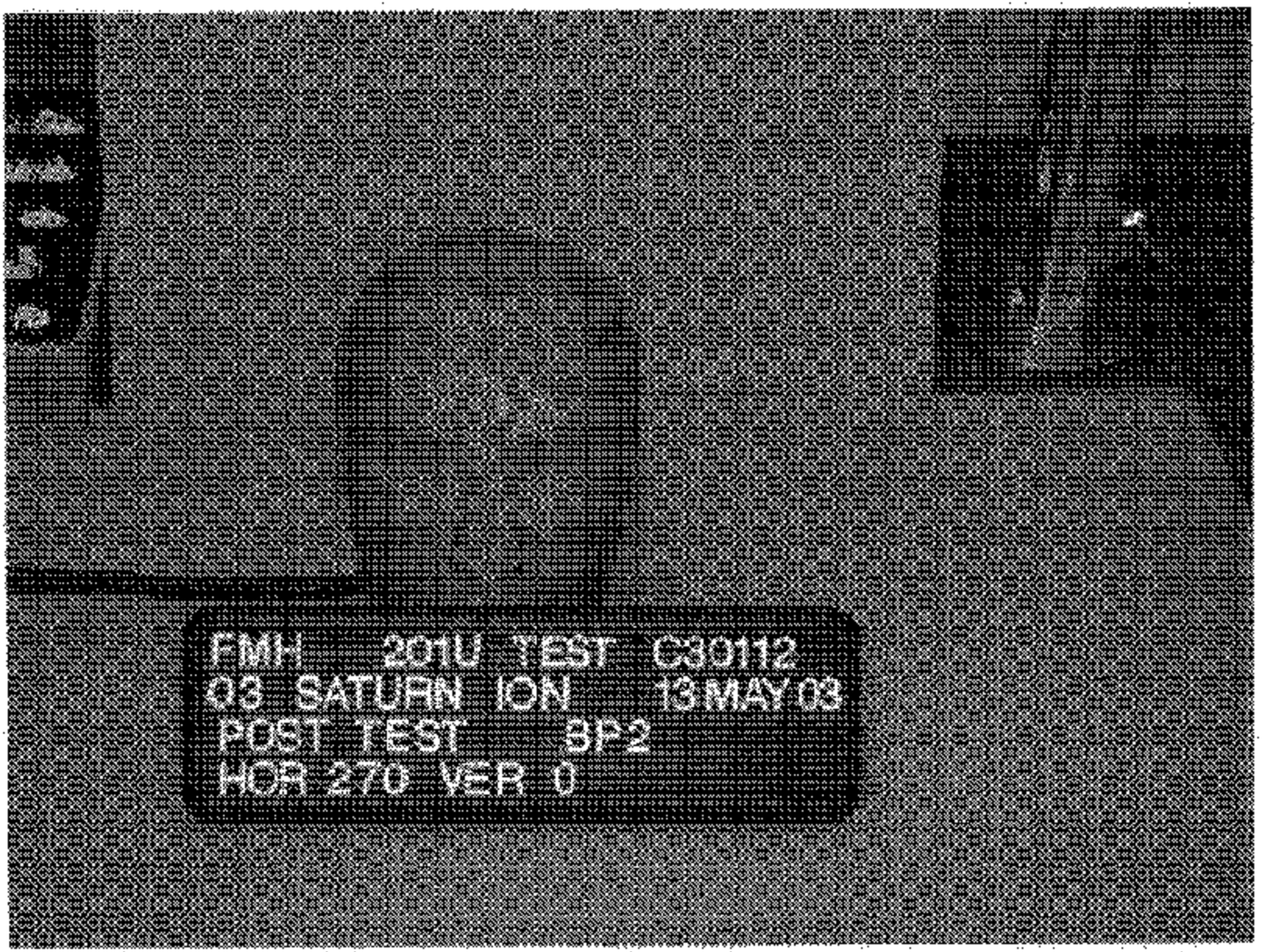


Figure : BP2 HEADFORM

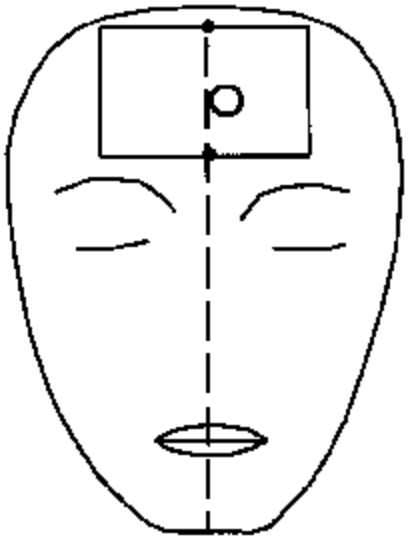
ECE-TRH-12

Year/Make/Model/Body Style:	2003 Saturn Ion 4 door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

Test Number:	8	Test Date:	MAY 13, 2003
Target Location:	UPPER ROOF	Target Code:	URBP
Horizontal Impact Angle:	270 °	Vertical Impact Angle:	35 °
Ambient Temperature:	22 °C	Time of Impact:	10:20
Headform Number:	0642		

Impact Point:
Description:

Description:	From lower midpoint				
On centerline	39	mm up			
On centerline	6	-	mm right	x	mm left



Free Motion HIC:	545.8	HIC(d):	578.2		
Impact Velocity (kph):	23.64	HICT1	1.9 msec	HICT2	11.0 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112

FMH Headform 0642

Test Date: May 13, 2003

Location: URBP

Work File: URBP

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 36 %

Velocity at Impact: 23.64 KPH

Free Flight Distance: 218.39 mm

HICd: 578.2

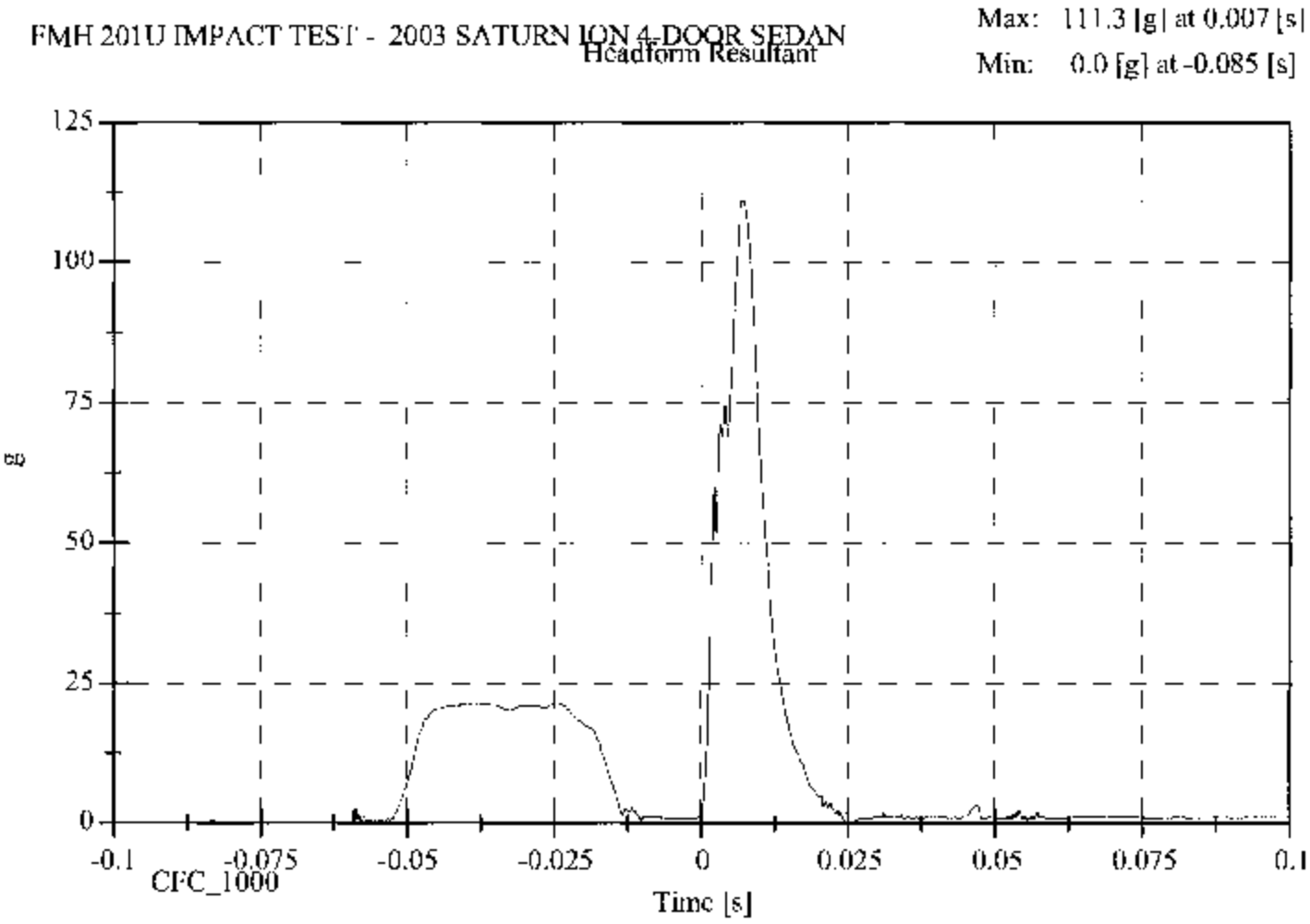
HIC (36ms): 545.8

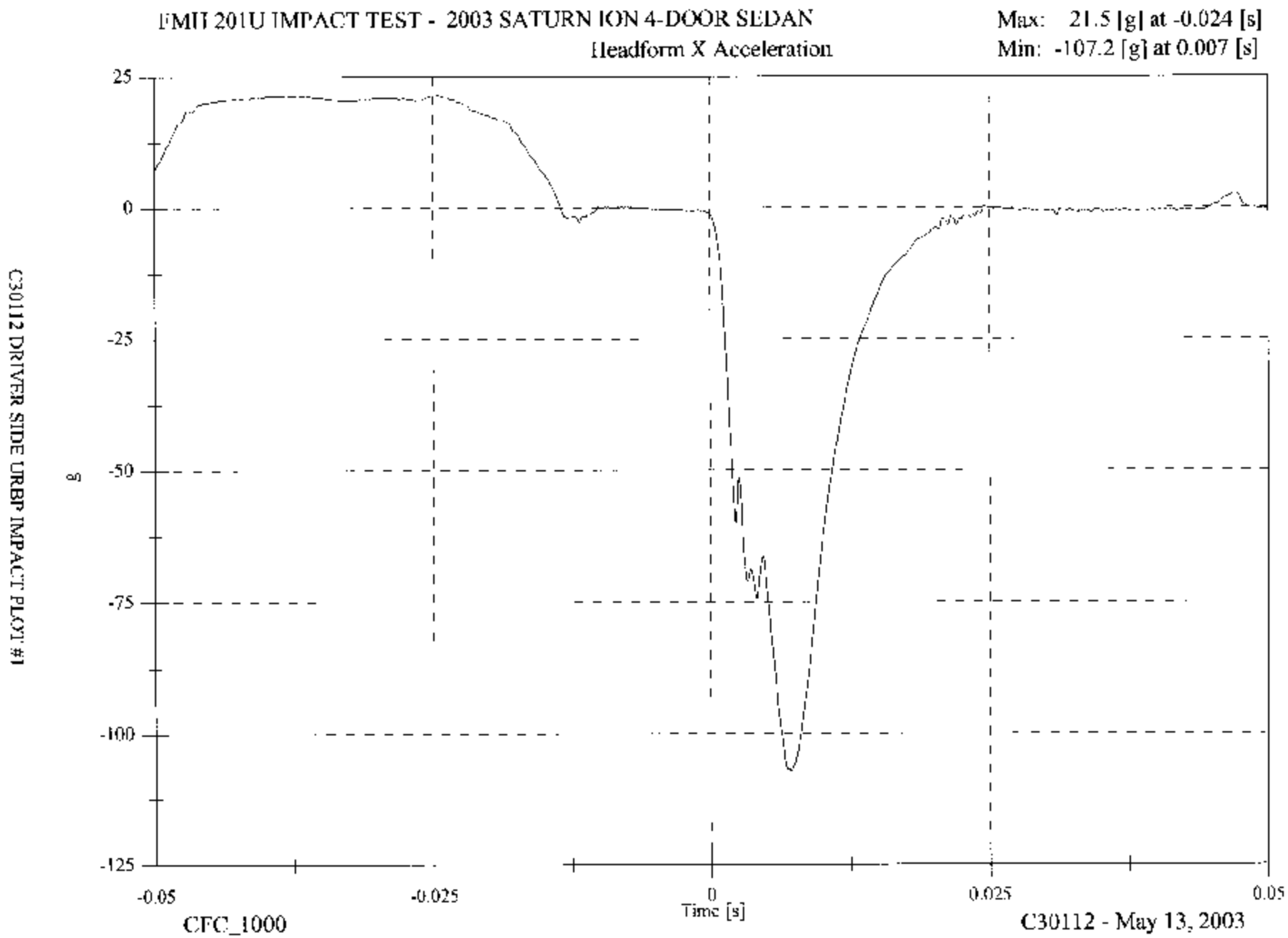
t1: 1.9 msec

t2: 11.0 msec

Duration: 9.1 msec

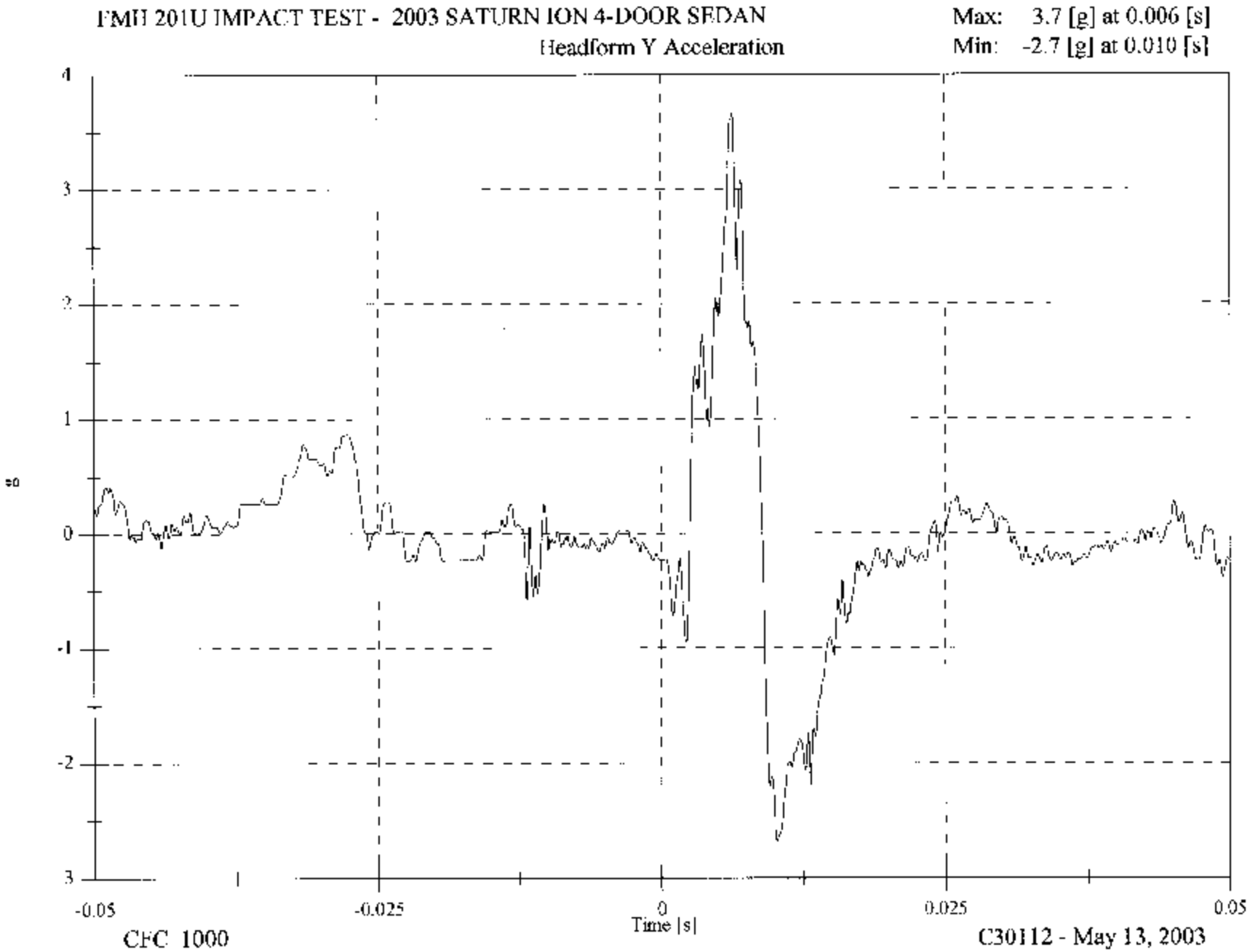
Average Acceleration: 8.8 g





C30112 DRIVER SIDE URBP IMPACT PLOT #1

C30112 DRIVER SIDE URBP IMPACT PLOT #2



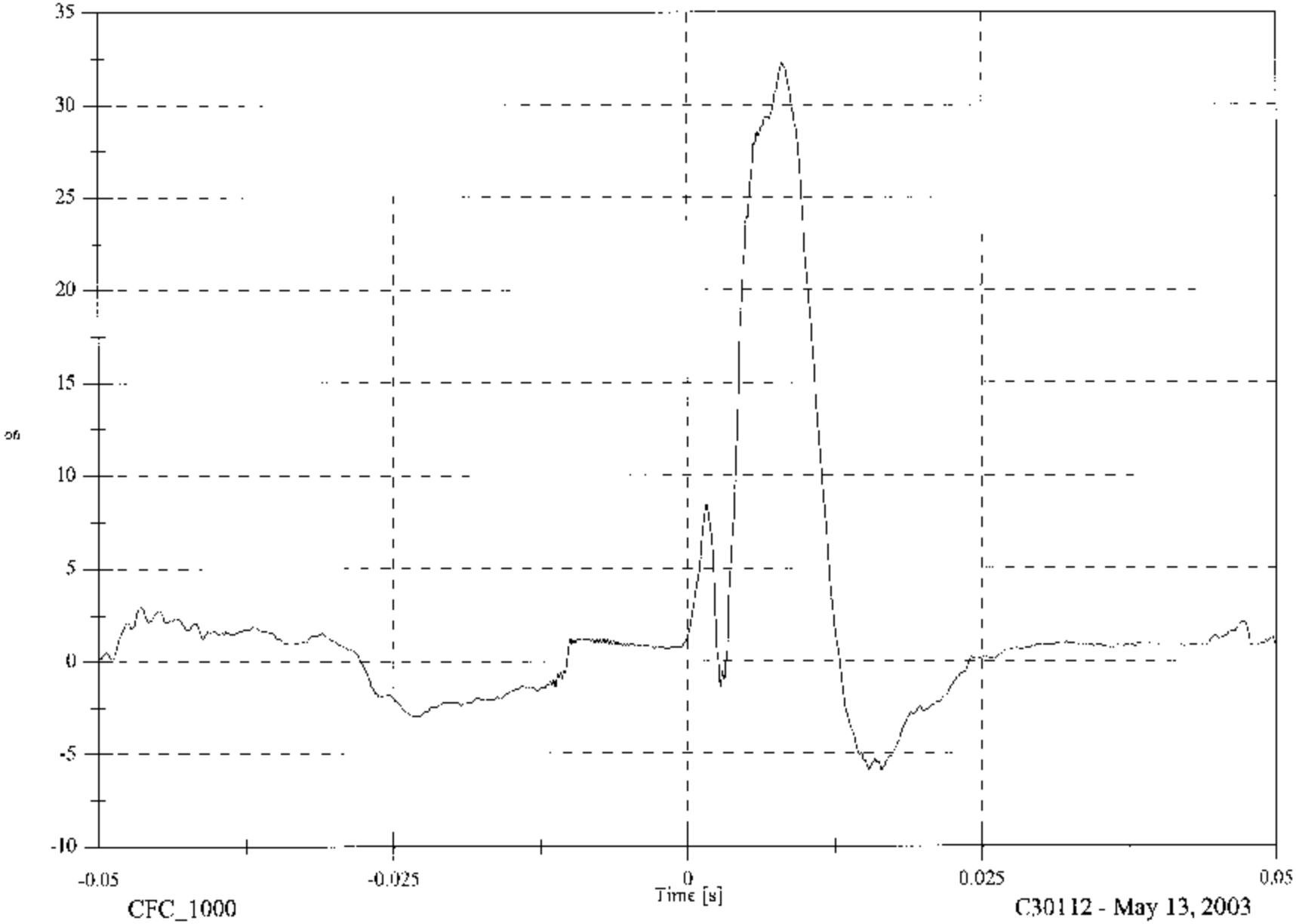
C30112 DRIVER SIDE URBP IMPACT PLOT #3

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Z Acceleration

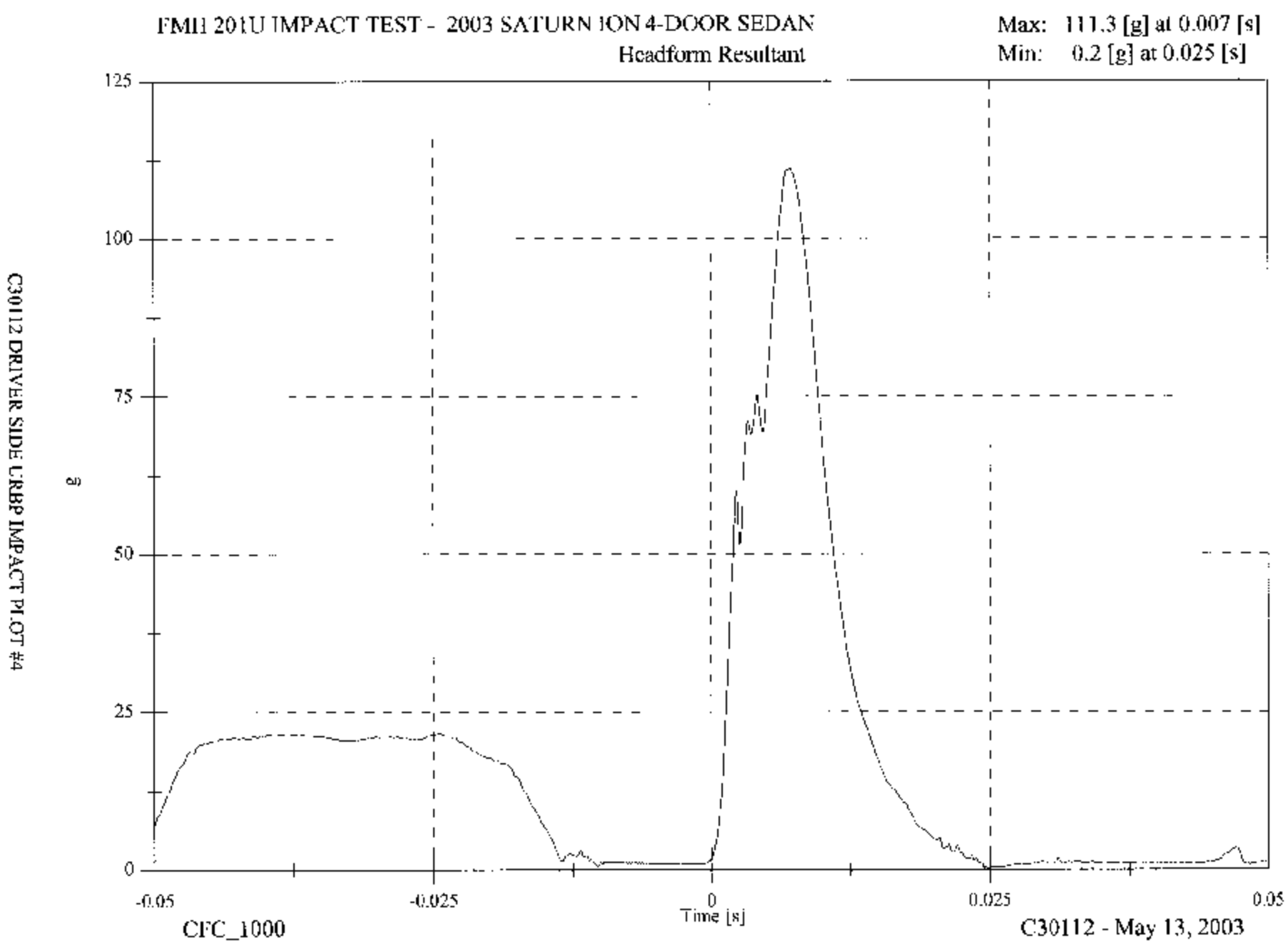
Max: 32.3 [g] at 0.008 [s]

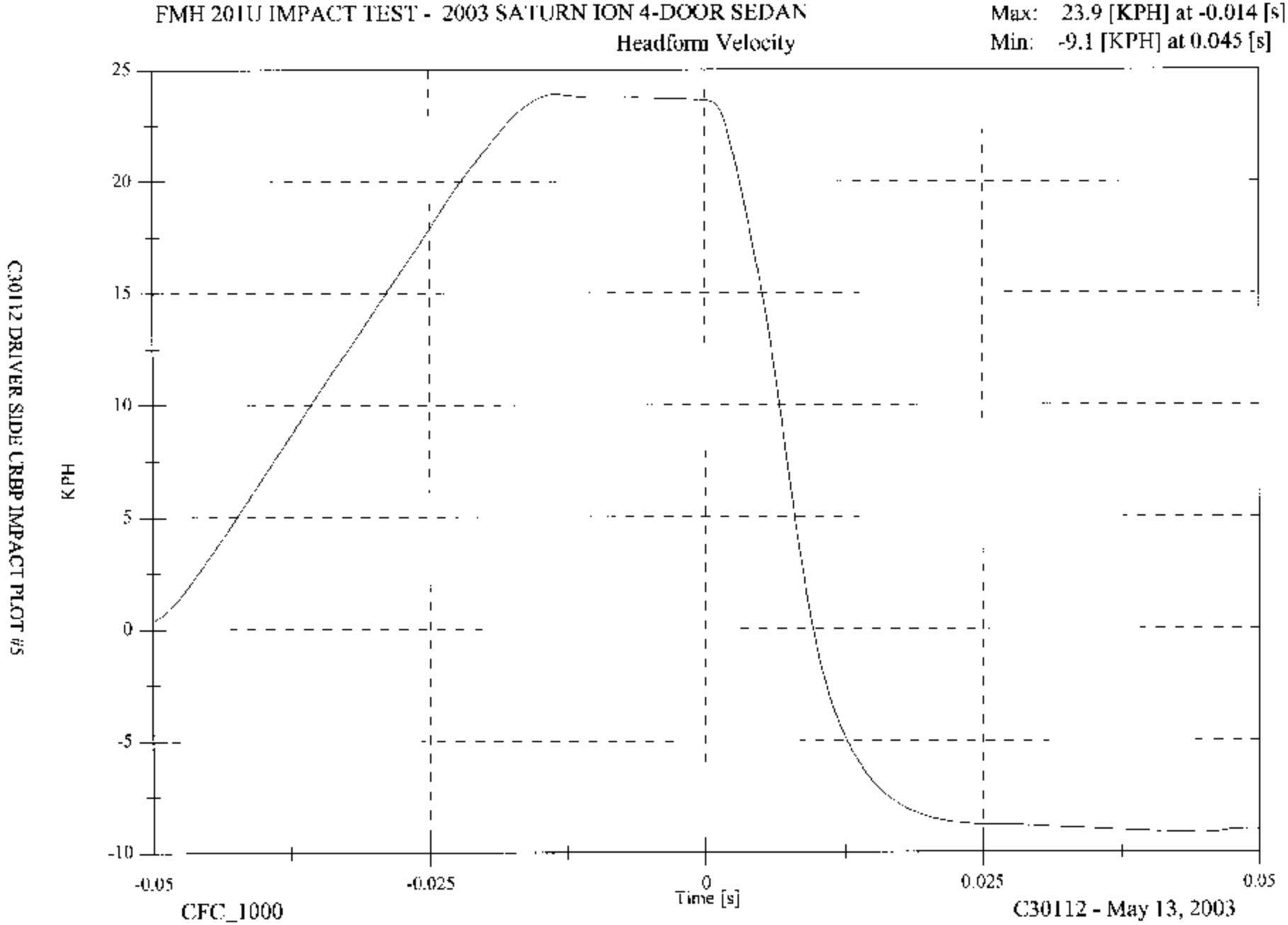
Min: -5.9 [g] at 0.016 [s]



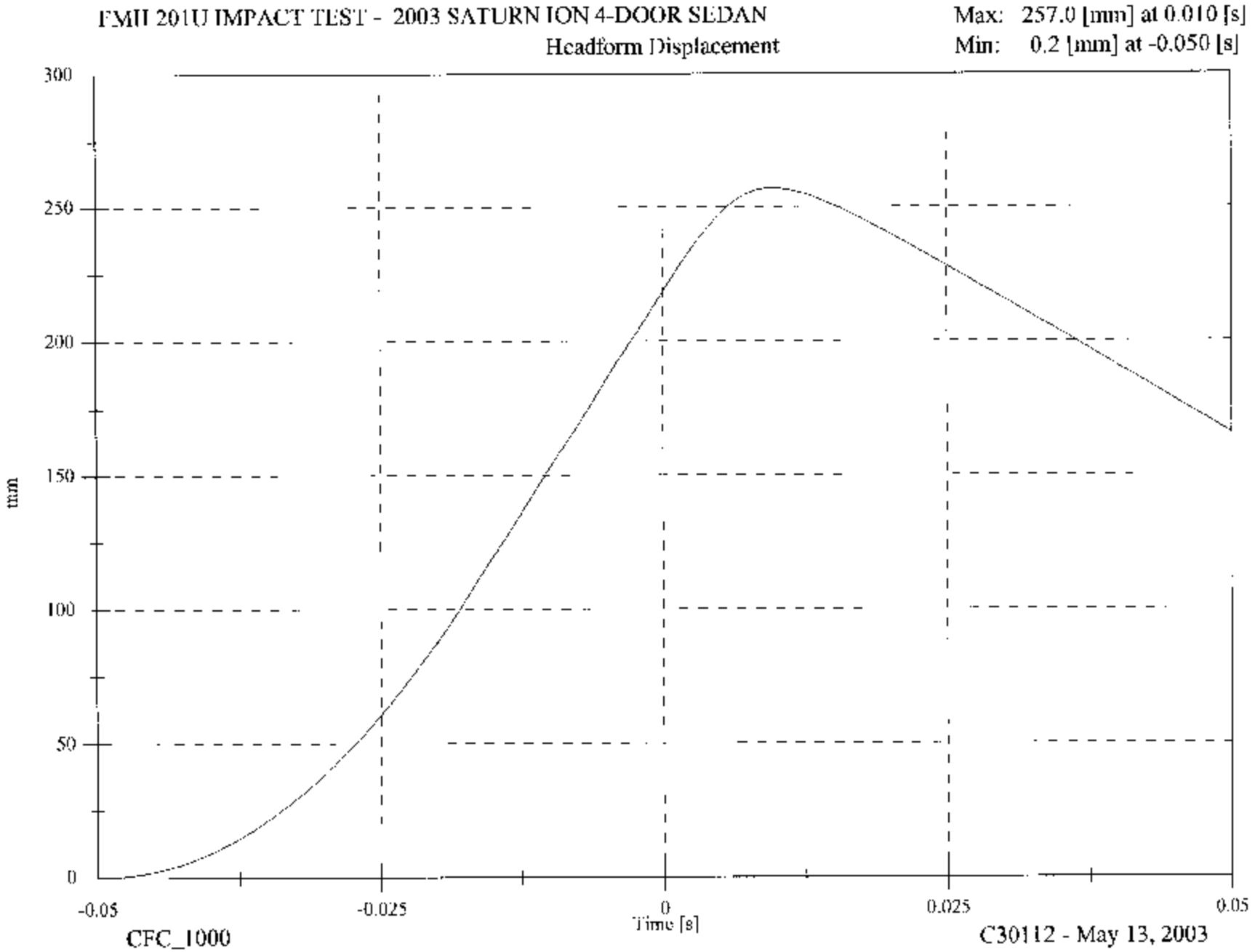
CFC_1000

C30112 - May 13, 2003


FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Resultant
Max: 111.3 [g] at 0.007 [s]
Min: 0.2 [g] at 0.025 [s]
125
100
75
50
25
0
g
-0.05
-0.025
0
0.025
0.05
Time [s]
CFC_1000
C30112 - May 13, 2003
C30112 DRIVER SIDE LRBF IMPACT PLOT #4


FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Velocity
Max: 23.9 [KPH] at -0.014 [s]
Min: -9.1 [KPH] at 0.045 [s]
C30112 DRIVER SIDE CRBP IMPACT PLOT #5
KPH
25
20
15
10
5
0
-5
-10
-0.05
-0.025
0
0.025
0.05
Time [s]
CFC_1000
C30112 - May 13, 2003

C30112 DRIVER SIDE LRBP IMPACT PLOT #6



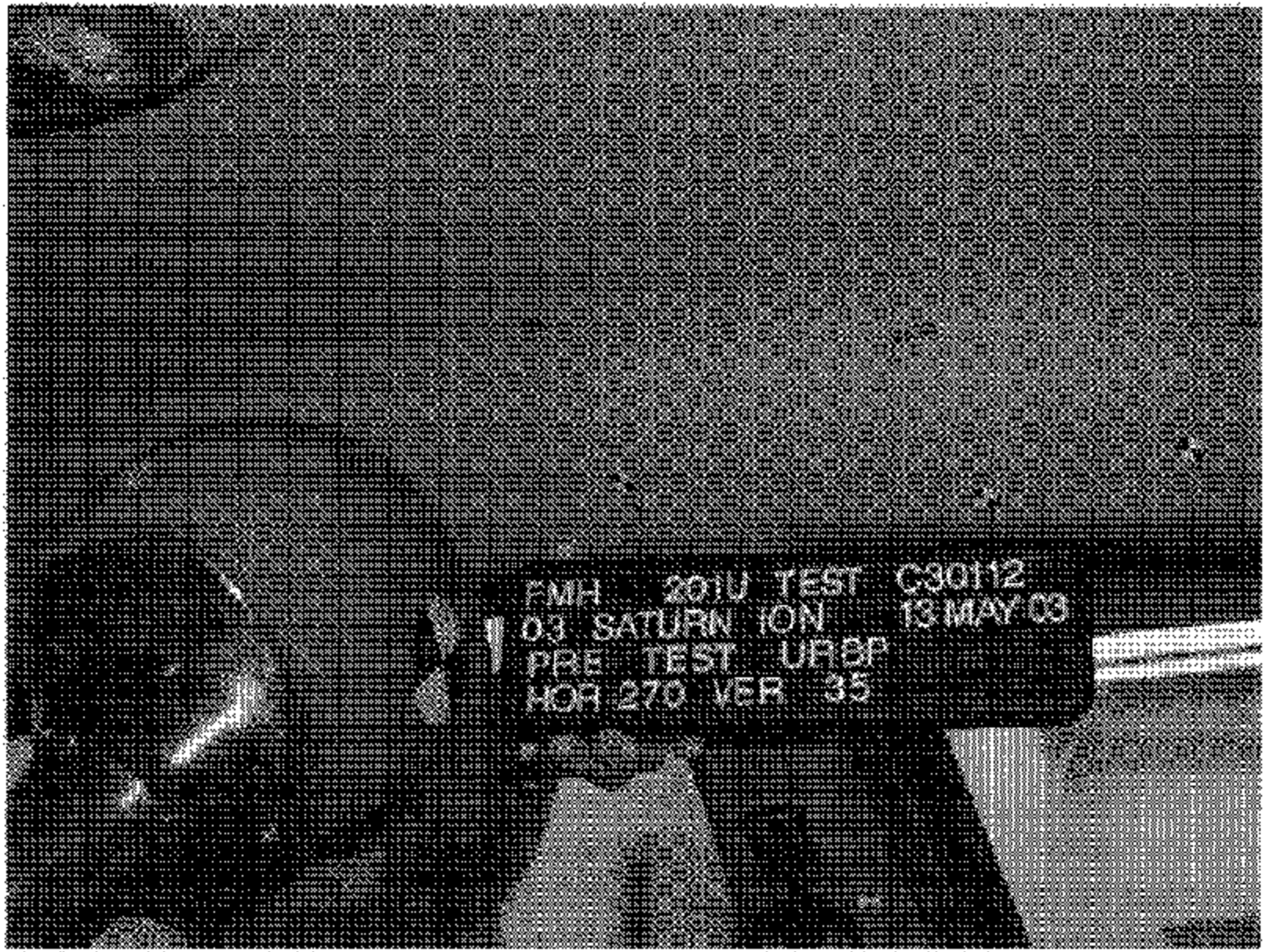


Figure : PRE-TEST URBP

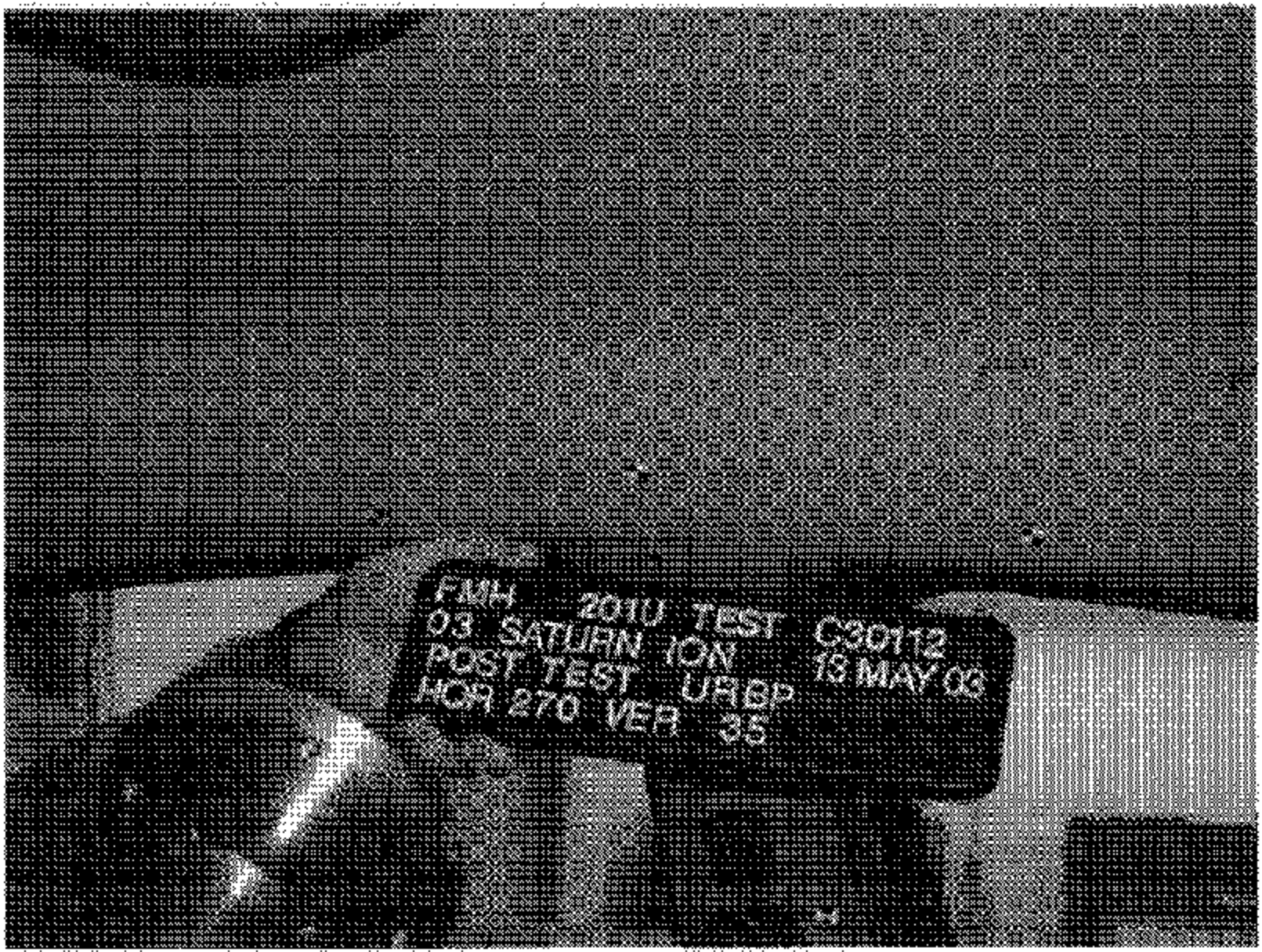
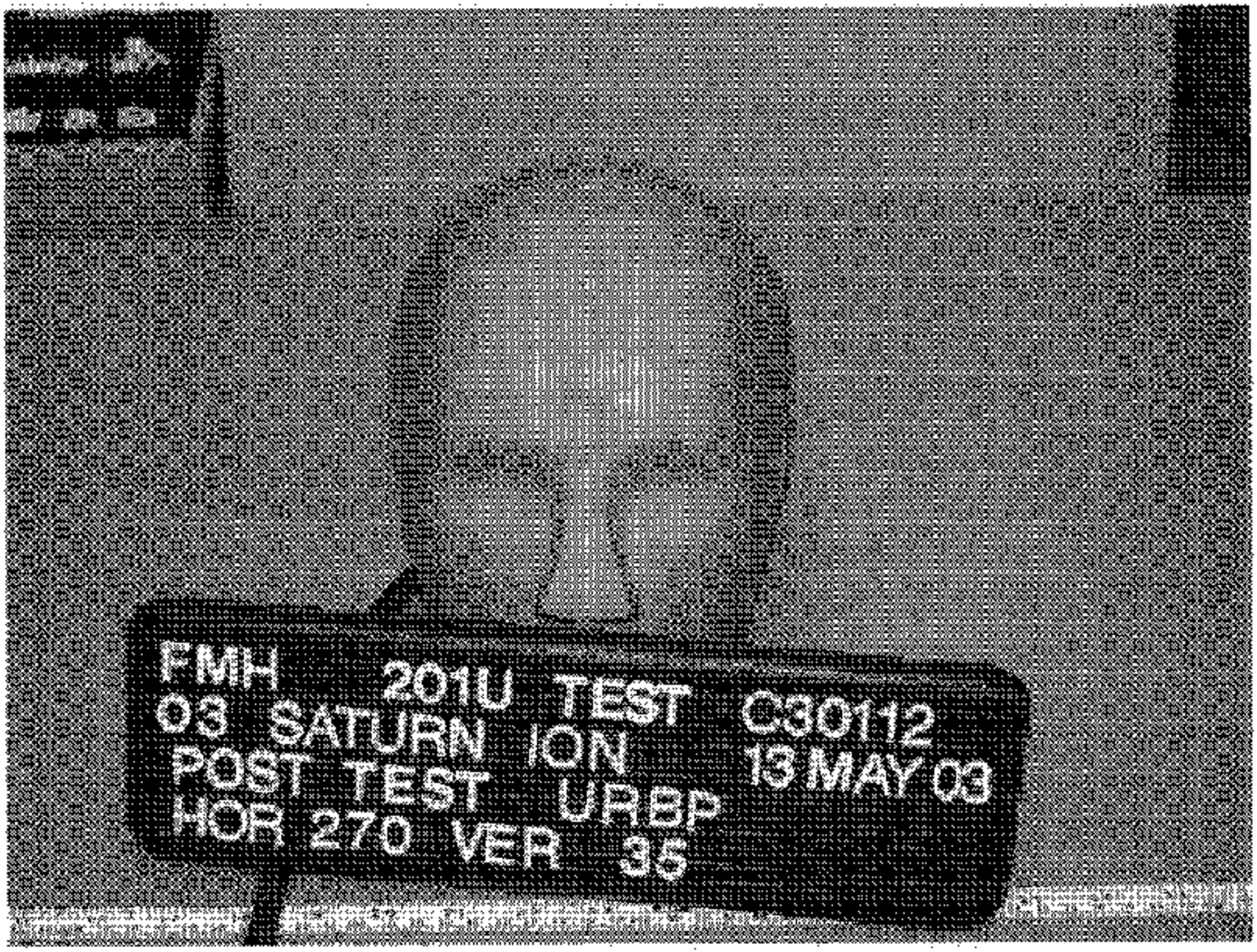


Figure : POST-TEST URBP



8651-FMH-12

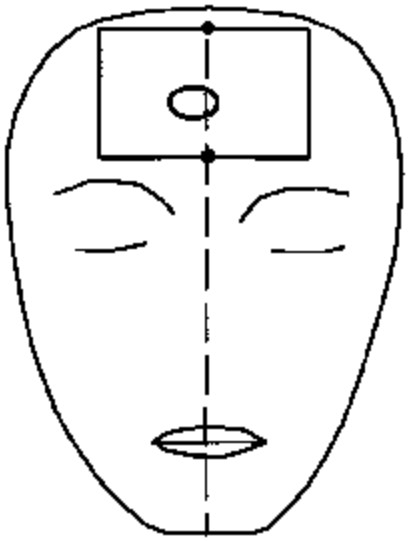
Figure : URBP HEADFORM

Year/Make/Model/Body Style:	2003 Saturn Ion 4-door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

Test Number:	9	Test Date:	MAY 13, 2003
Target Location:	REAR PILLAR	Target Code:	RP2
Horizontal Impact Angle:	295 °	Vertical Impact Angle:	0 °
Ambient Temperature:	22 °C	Time of Impact:	11:00
Headform Number:	0355		

Impact Point:
Description:

Description:	From lower midpoint				
On centerline	42	mm up			
On centerline	5	x	mm right	-	mm left



Free Motion HIC:	310.5	HIC(d):	400.7		
Impact Velocity (kph):	23.51	HICT1	1.9 msec	HICT2	17.4 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112 - RP2

FMH Headform 0355

Test Date: May 13, 2003

Location: RP2

Work File: RP2

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 36 %

Velocity at Impact: 23.51 KPH

Free Flight Distance: 213.51 mm

HICd: 400.7

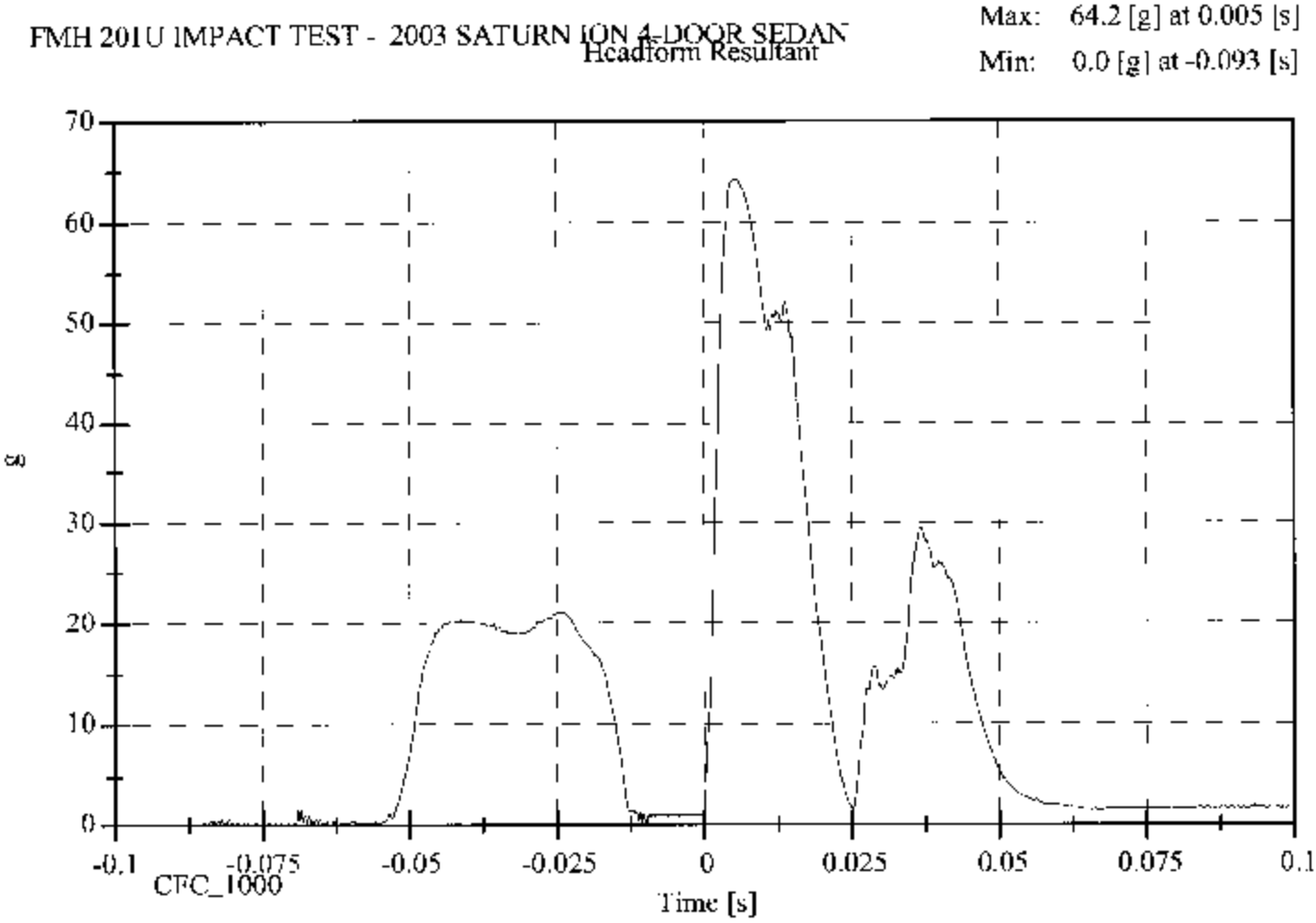
HIC (36ms): 310.5

t1: 1.9 msec

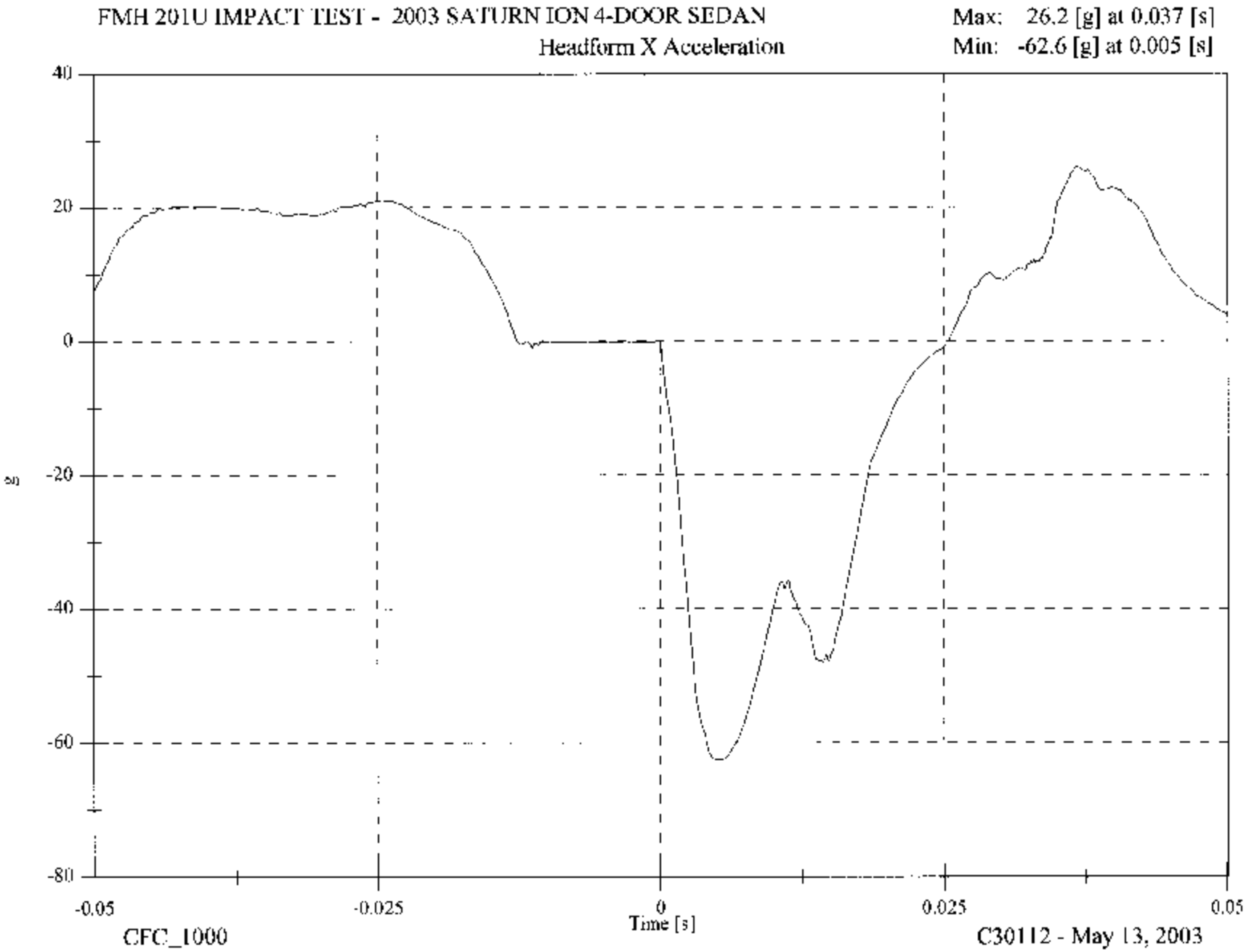
t2: 17.4 msec

Duration: 15.5 msec

Average Acceleration: 10.8 g



C30112 DRIVER SIDE RP2 IMPACT PLOT #1

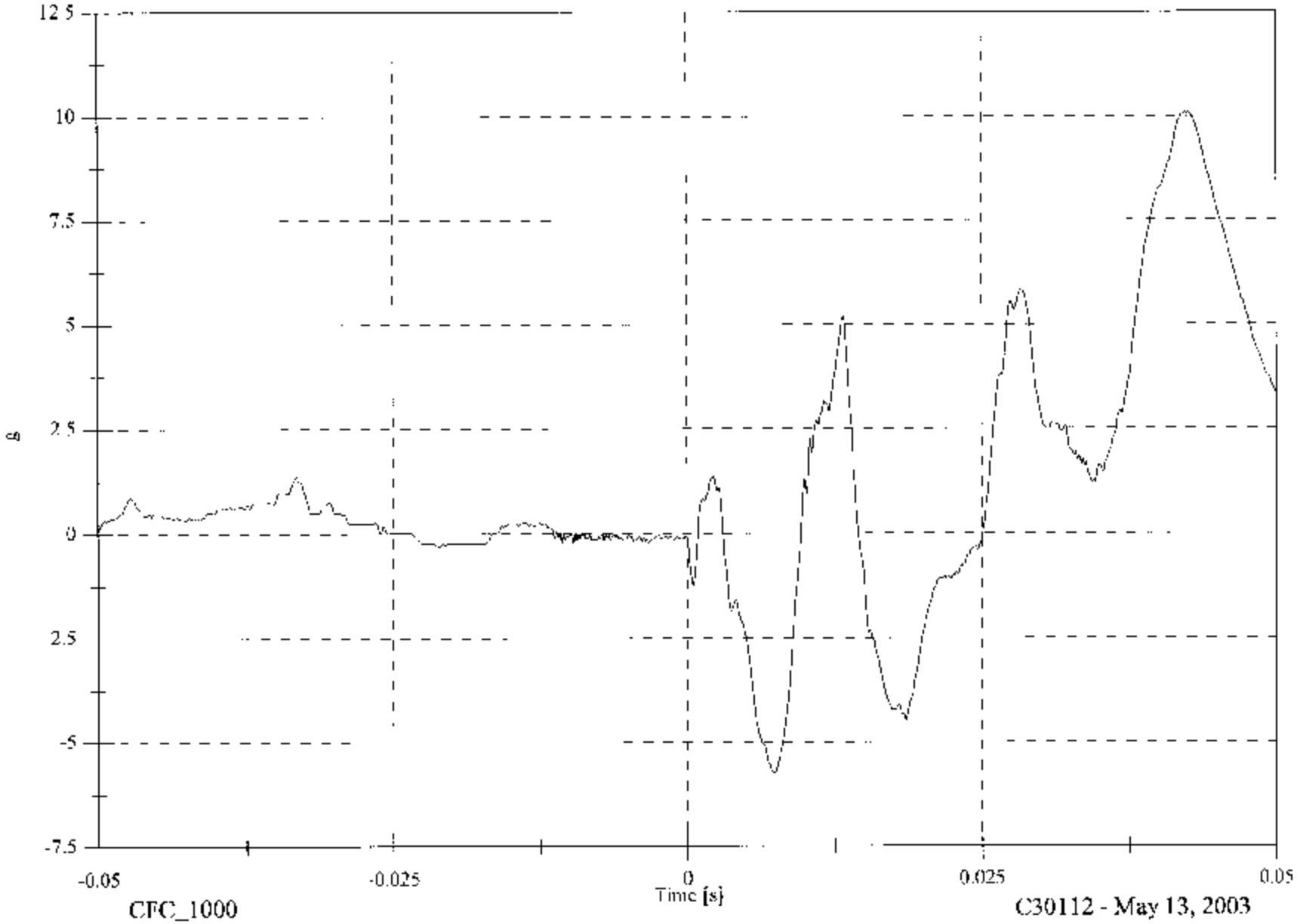


FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Y Acceleration

Max: 10.1 [g] at 0.043 [s]

Min: -5.7 [g] at 0.007 [s]

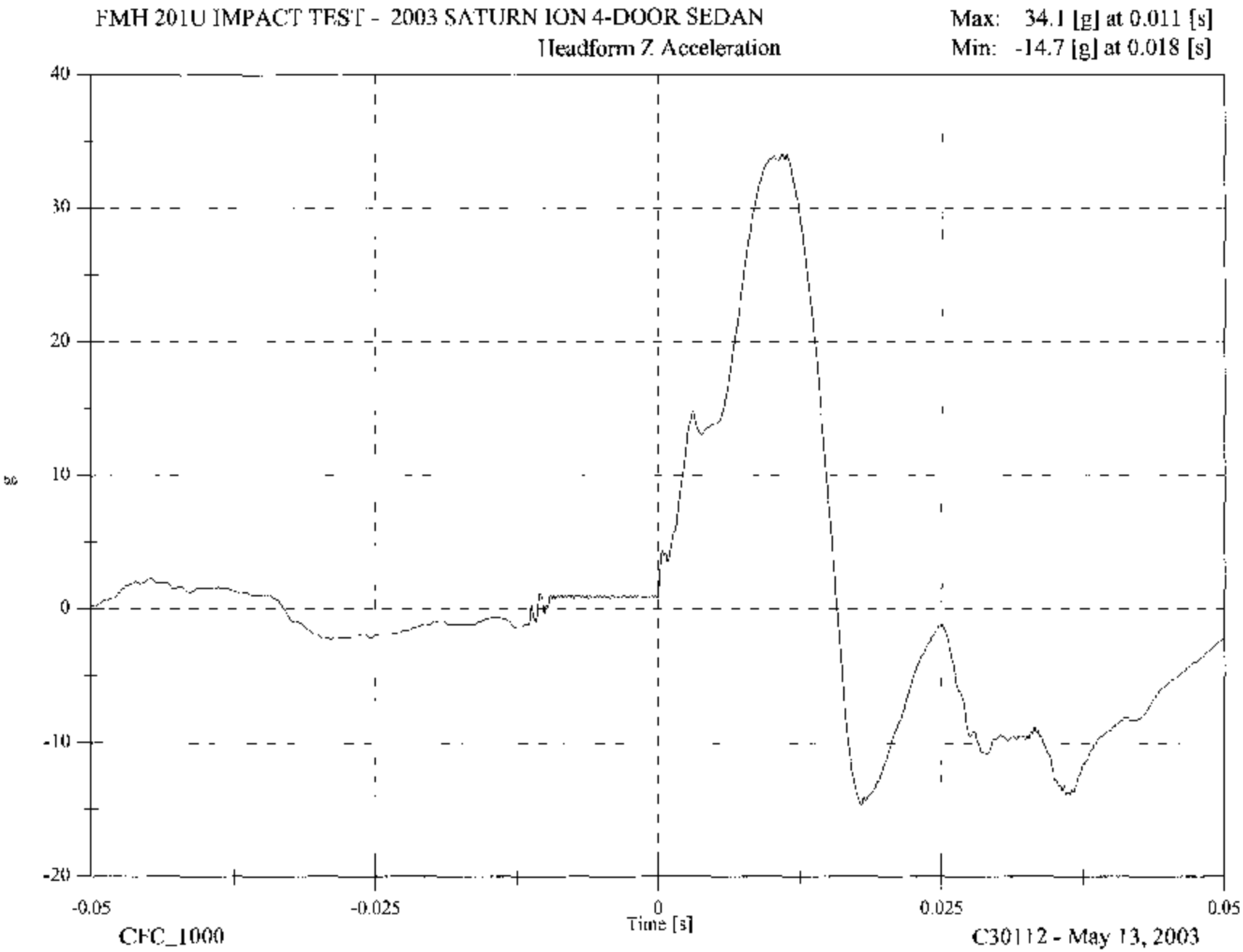


C30112 DRIVER SIDE RP2 IMPACT PLOT #2

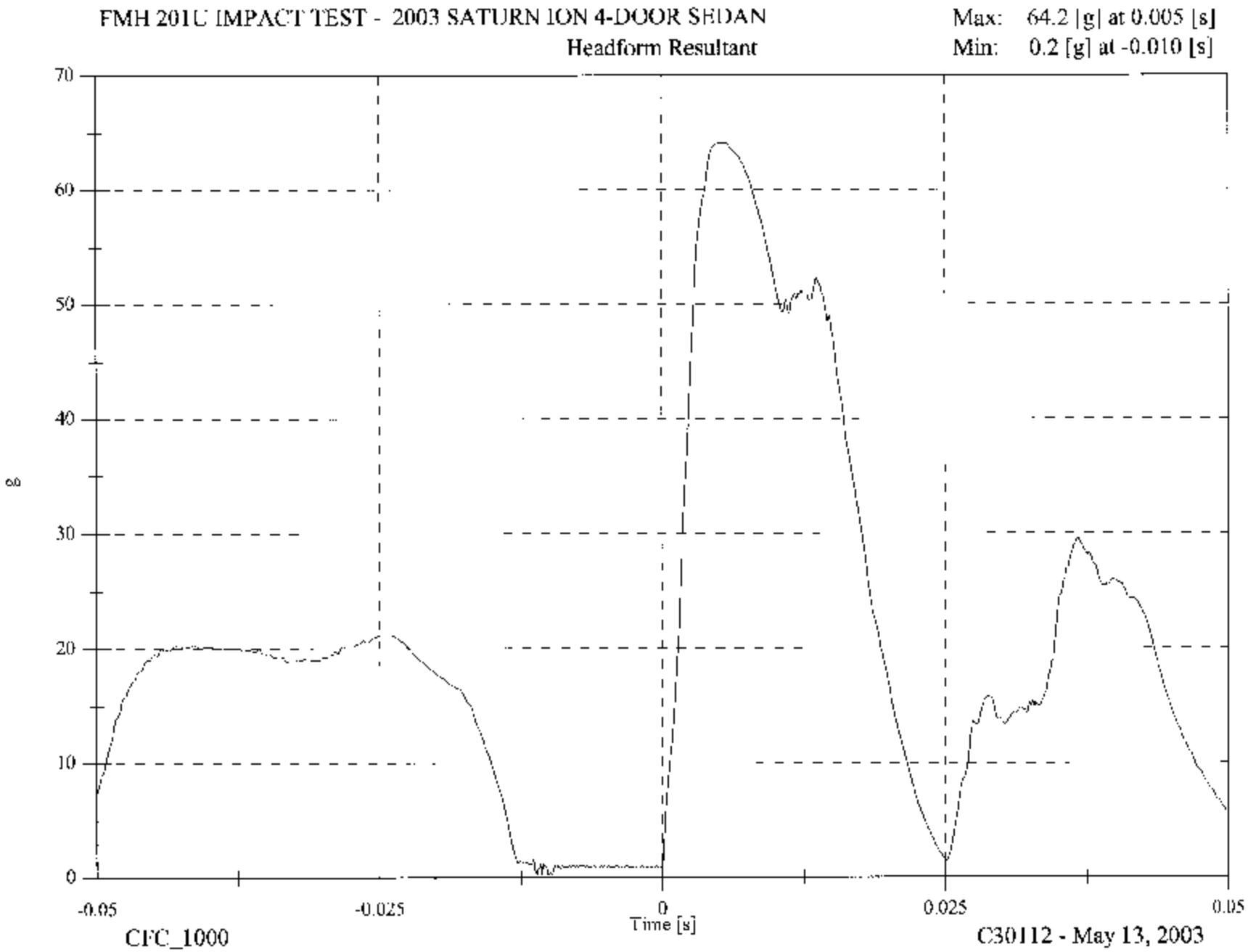
CFC_1000

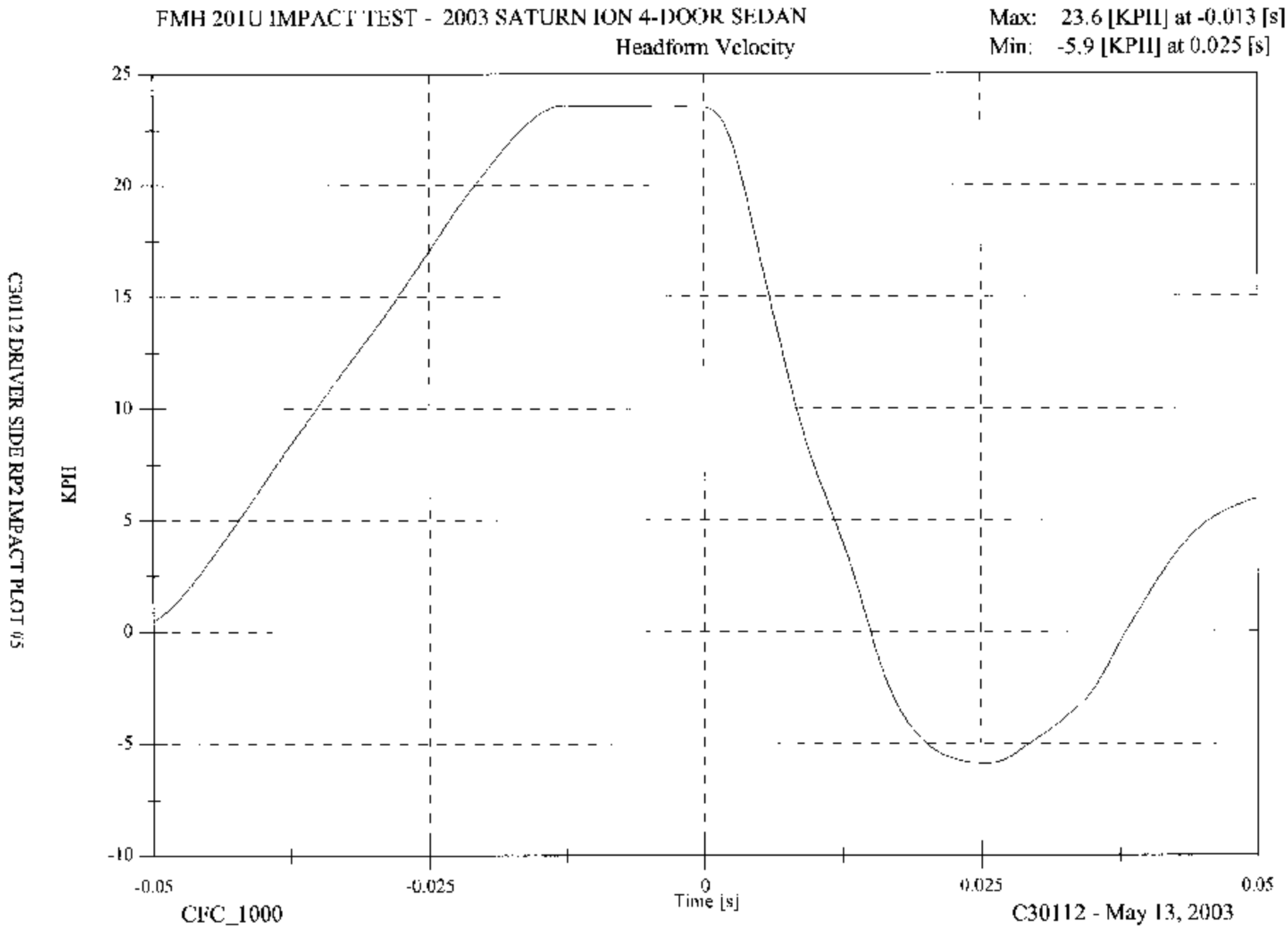
C30112 - May 13, 2003

C30112 DRIVER SIDE RP2 IMPACT PLOT #3



C30112 DRIVER SIDE RP2 IMPACT PLOT #4





C30112 DRIVER SIDE RP2 IMPACT PLOT #5

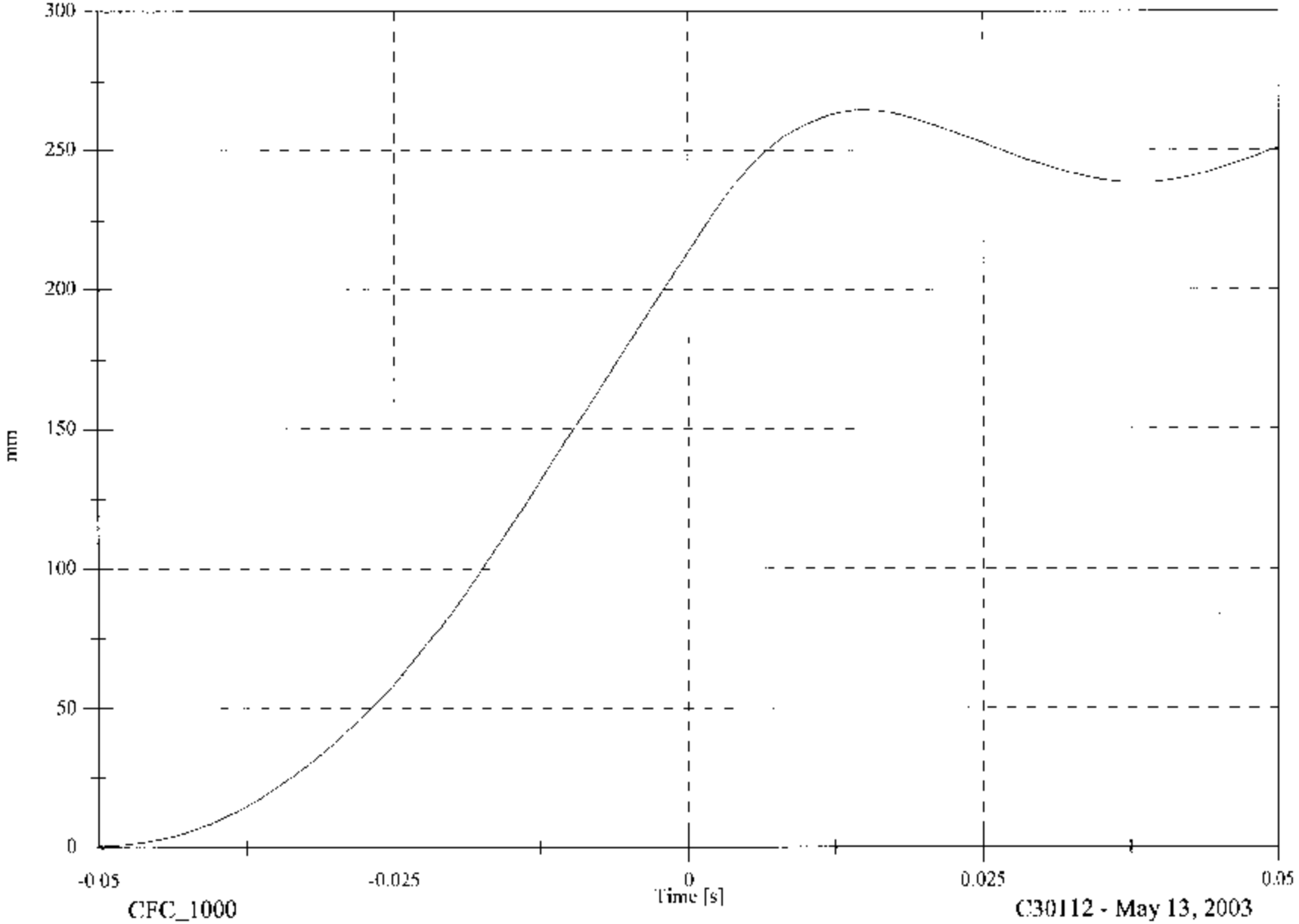
C30112 DRIVER SIDE RP2 IMPACT PLOT #6

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Displacement

Max: 264.7 [mm] at 0.015 [s]

Min: 0.6 [mm] at -0.050 [s]



CFC_1000

C30112 - May 13, 2003

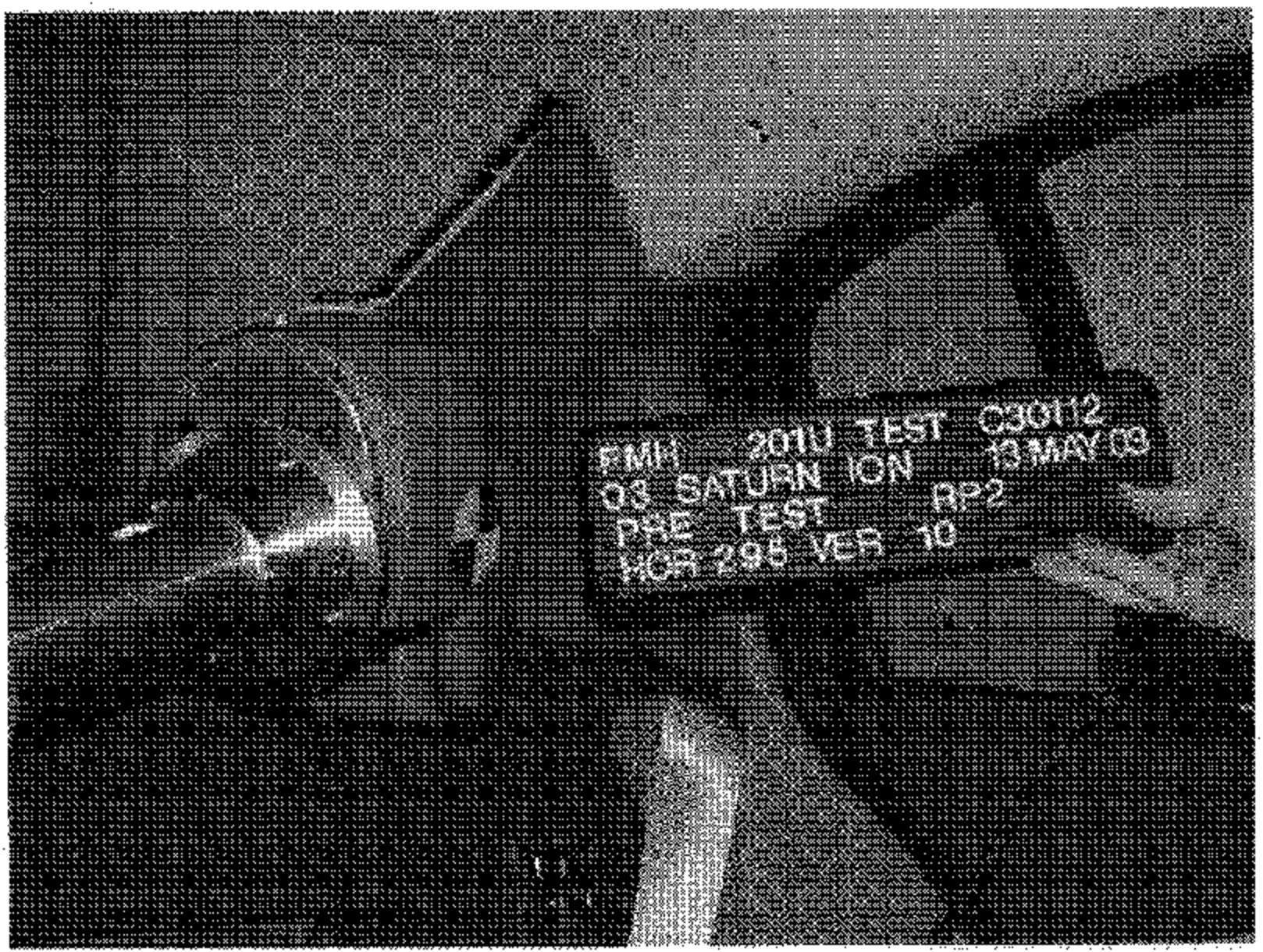


Figure : PRE-TEST RP2

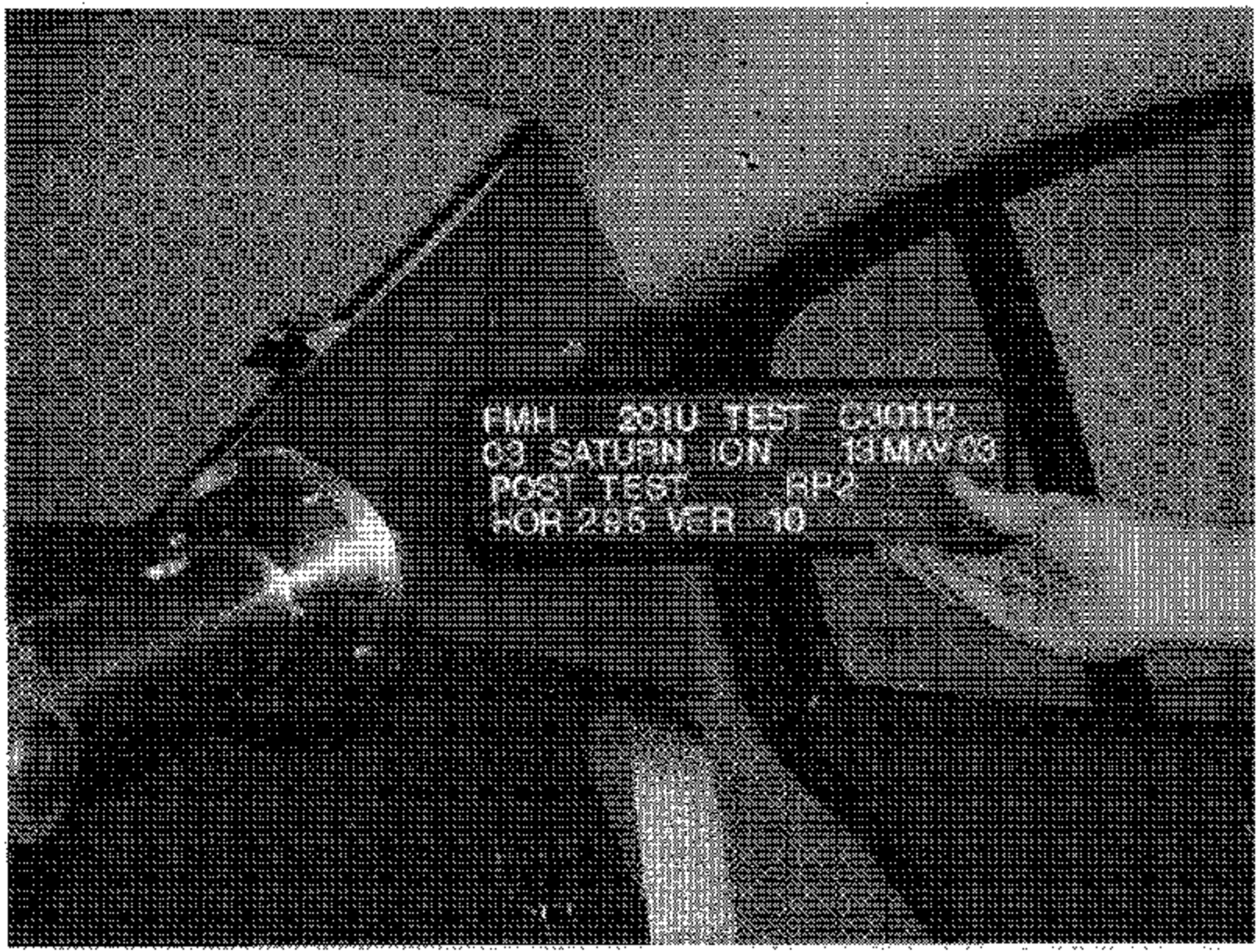


Figure : POST-TEST RP2

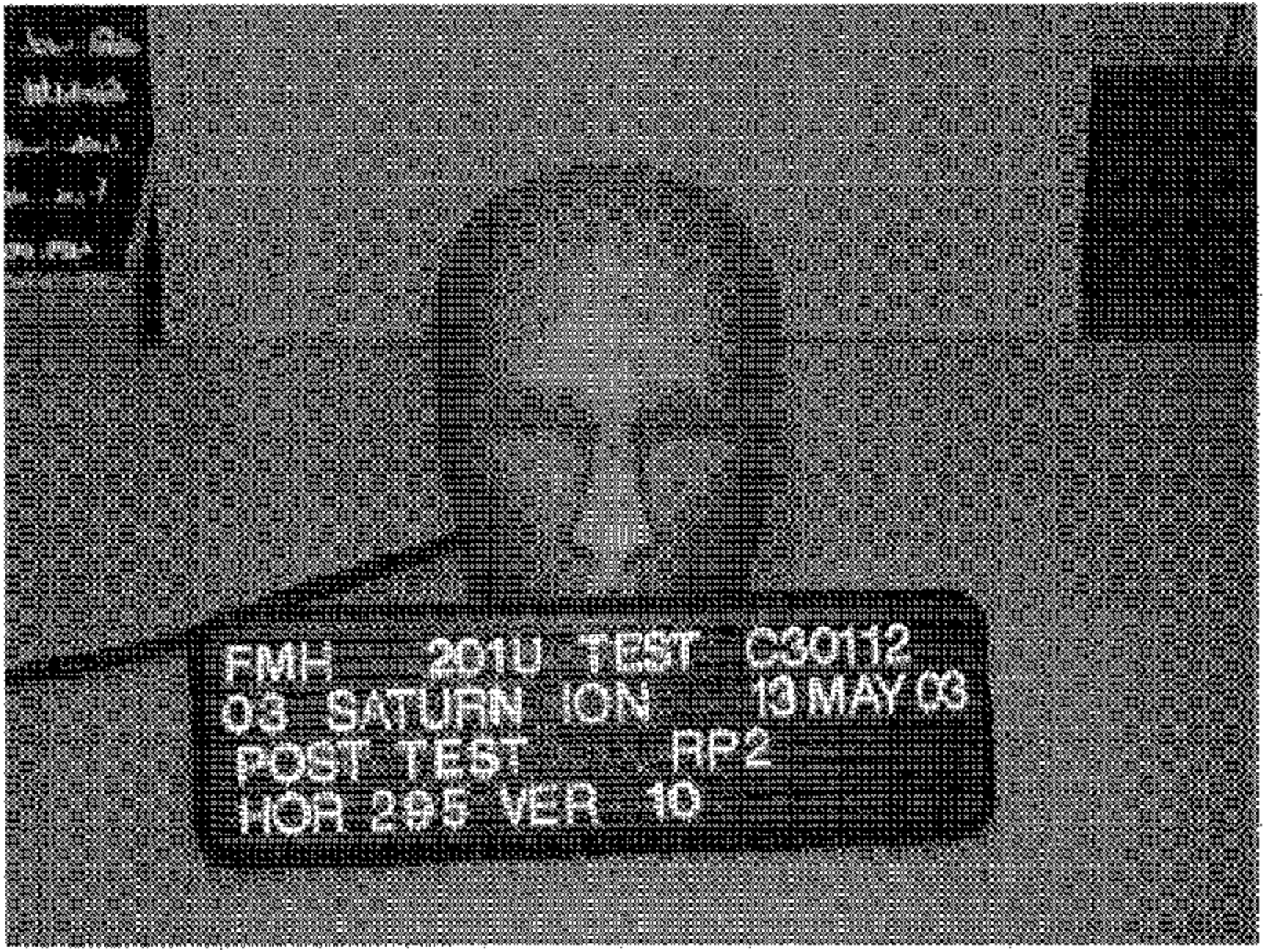


Figure : RP2 HEADFORM

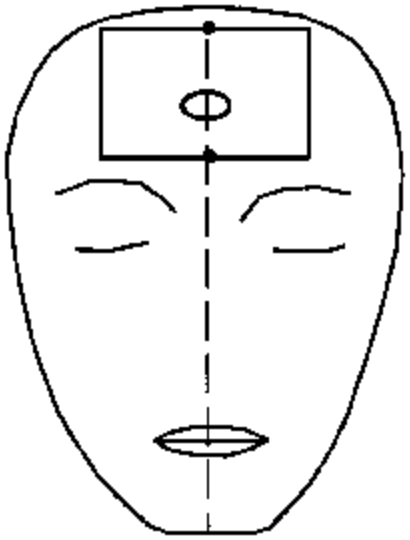
Year/Make/Model/Body Style:	2003 Saturn Ion 4-door Sedan		
Vehicle Body Color:	Silver	VIN:	1G8AF52F03Z138200
Vehicle NHTSA No.:	C30112	Month & Year of Manufacture:	01/03

Test Number:	10	Test Date:	MAY 13, 2003
Target Location:	A-PILLAR	Target Code:	AP3
Horizontal Impact Angle:	225 °	Vertical Impact Angle:	36 °
Ambient Temperature:	22 °C	Time of Impact:	1:55
Headform Number:	1255		

Impact Point:

Description:

Description:	From lower midpoint				
On centerline	29	mm up			
On centerline	0	-	mm right	-	mm left



Free Motion HIC:	984.6	HIC(d):	909.3		
Impact Velocity (kph):	23.69	HICT1	3.3 msec	HICT2	8.4 msec

Post-Test Comments:

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN C30112 - AP3

FMH Headform 1255

Test Date: May 13, 2003

Location: AP3

Work File: AP3

----------TEST RESULTS----------

Lab Temperature: 22 C

Lab Humidity: 36 %

Velocity at Impact: 23.69 KPH

Free Flight Distance: 220.51 mm

HICd: 909.3

HIC (36ms): 984.6

t1: 3.3 msec

t2: 8.4 msec

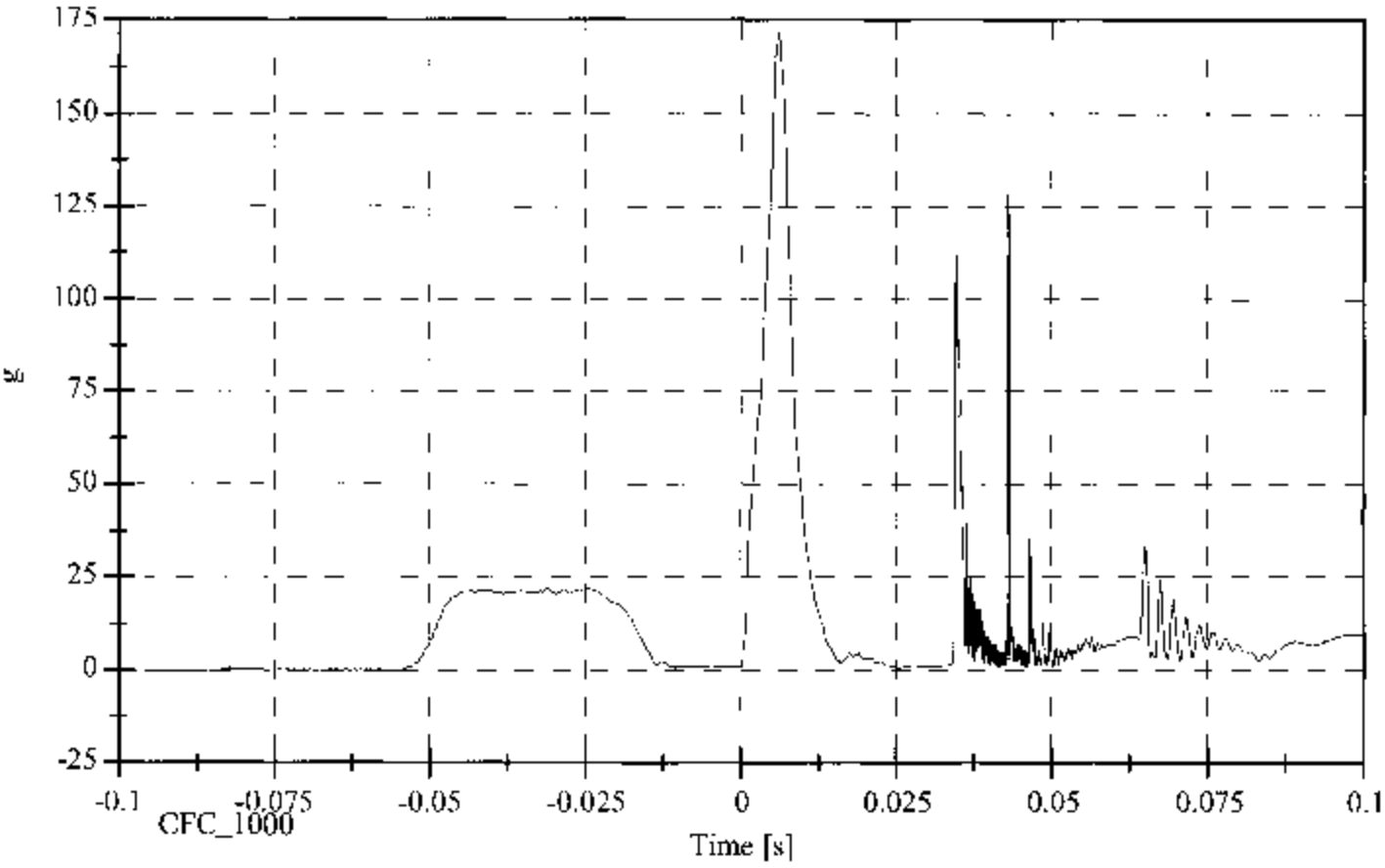
Duration: 5.0 msec

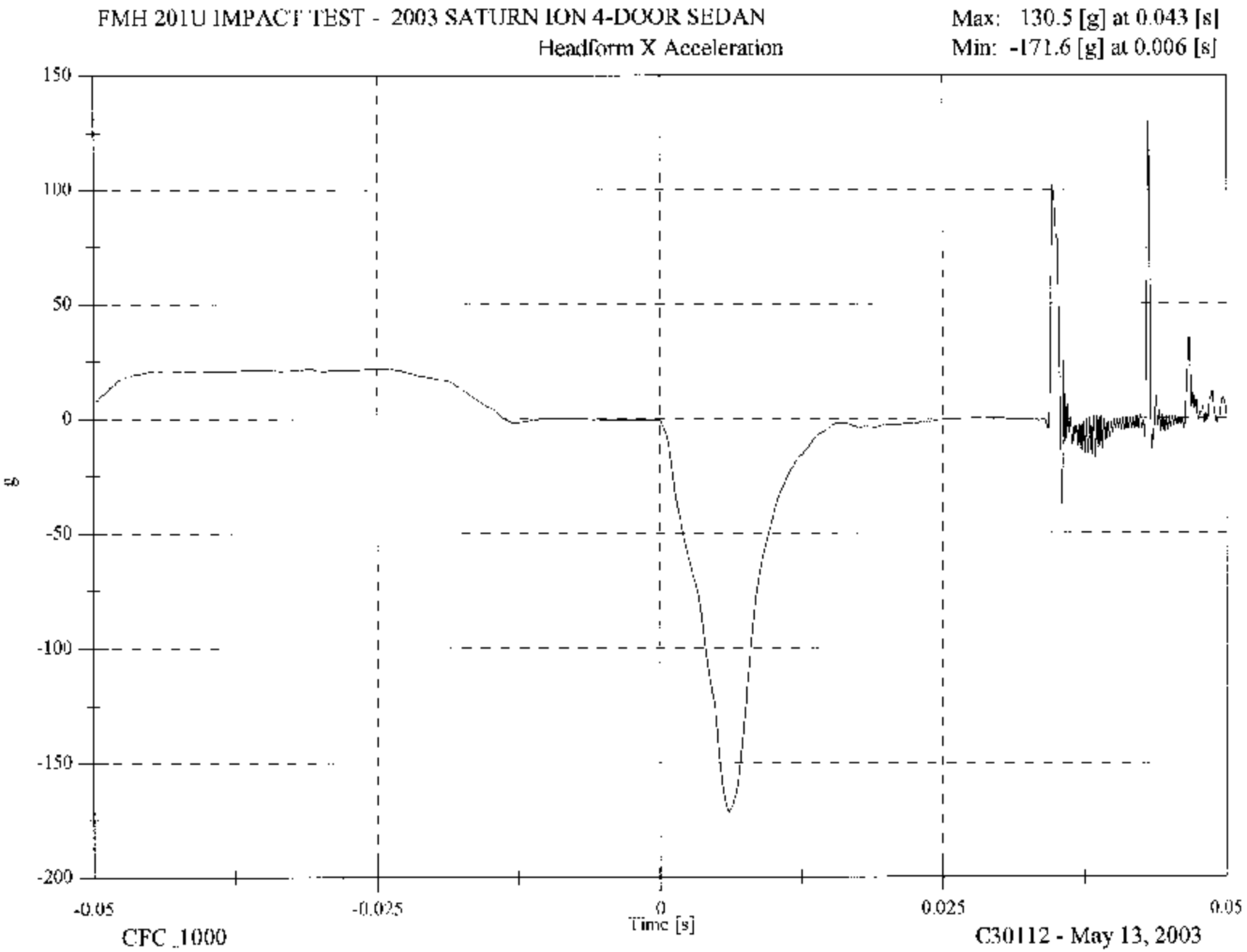
Average Acceleration: 11.7 g

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN
Headform Resultant

Max: 171.9 [g] at 0.006 [s]

Min: -0.0 [g] at -0.099 [s]





C30112 DRIVER SIDE AP3 IMPACT PLOT #1

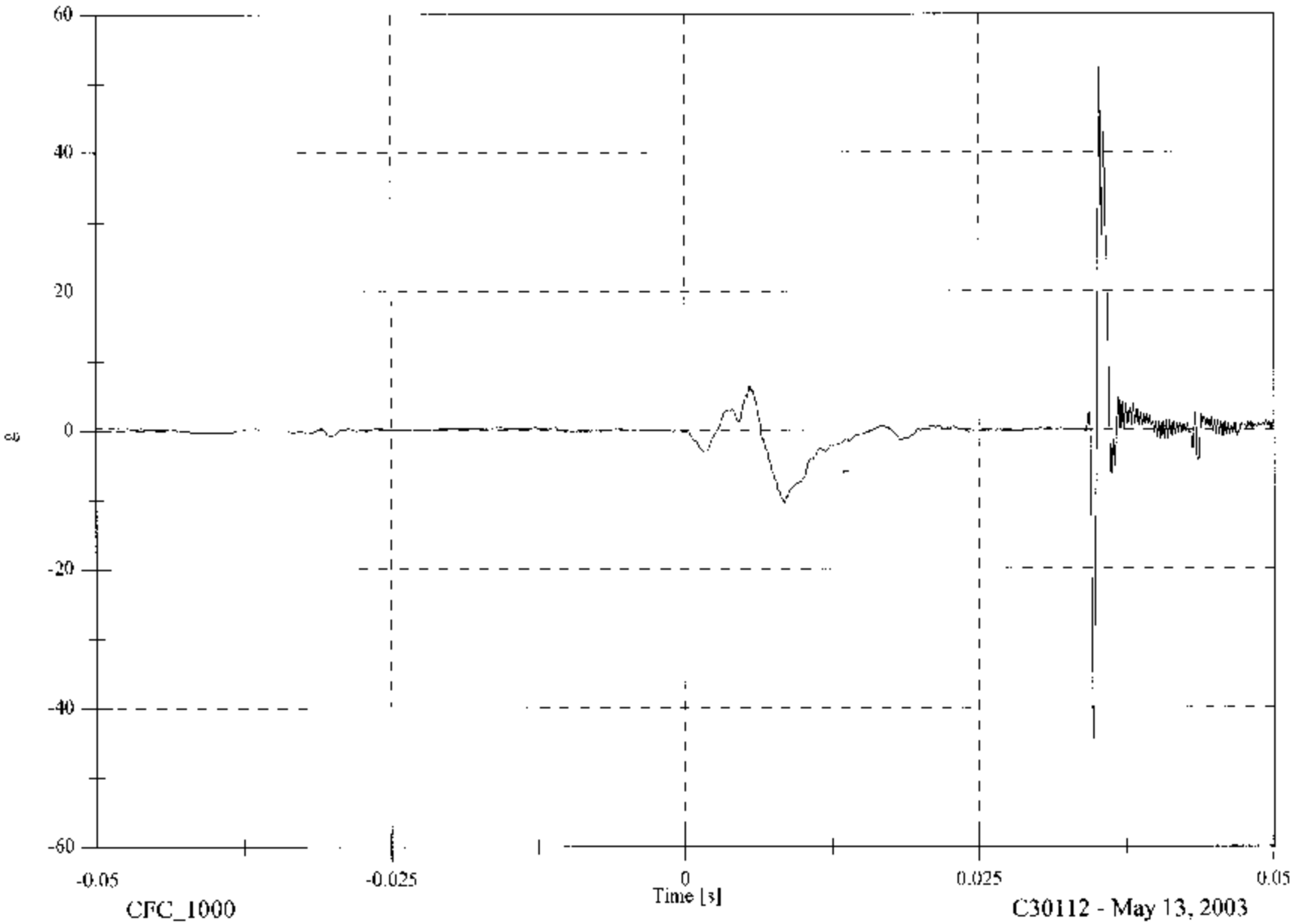
C30112 DRIVER SIDE AP3 IMPACT PLOT #2

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Y Acceleration

Max: 52.3 [g] at 0.035 [s]

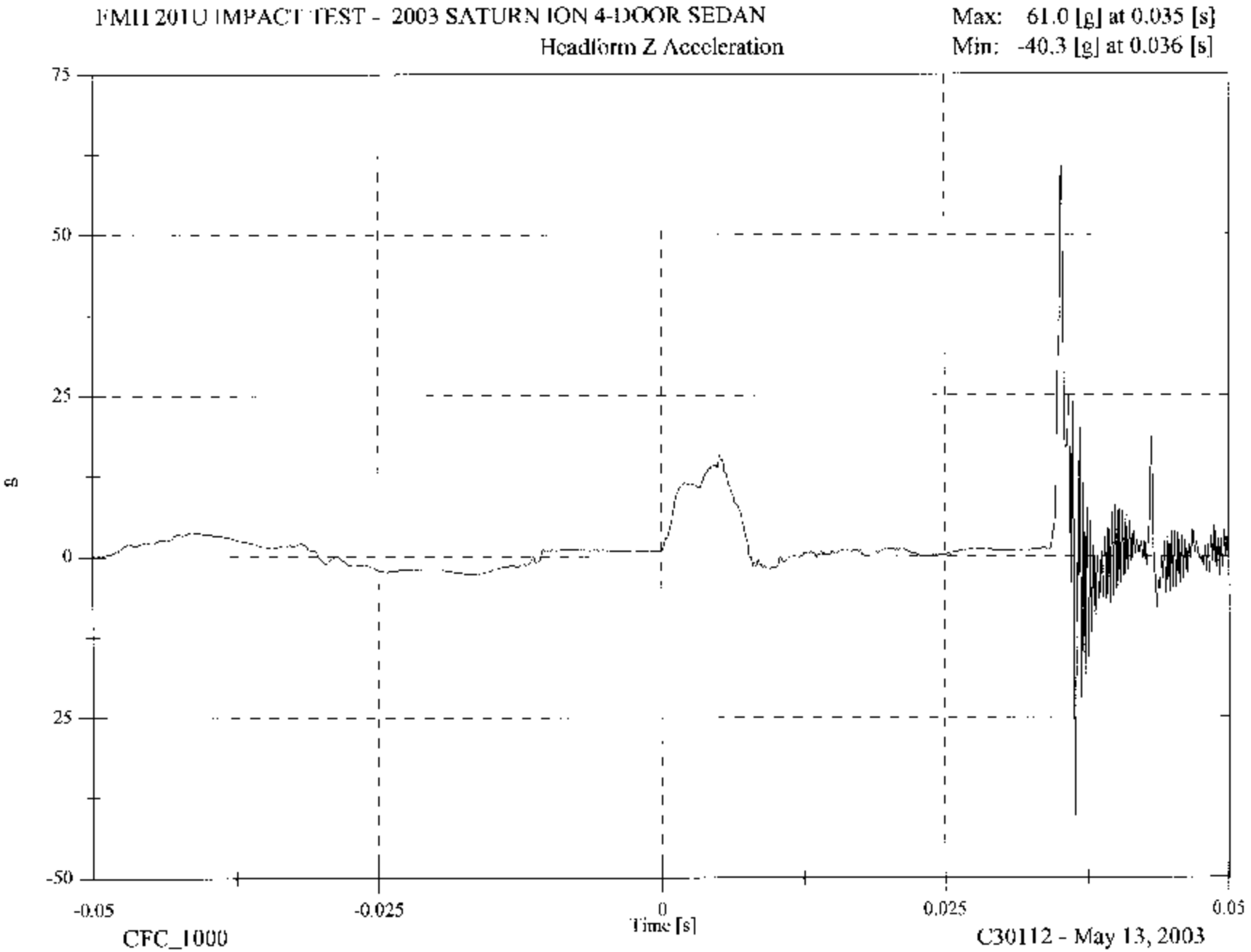
Min: -44.5 [g] at 0.035 [s]



CFC_1000

C30112 - May 13, 2003

C30112 DRIVER SIDE AP3 IMPACT PLOT #3



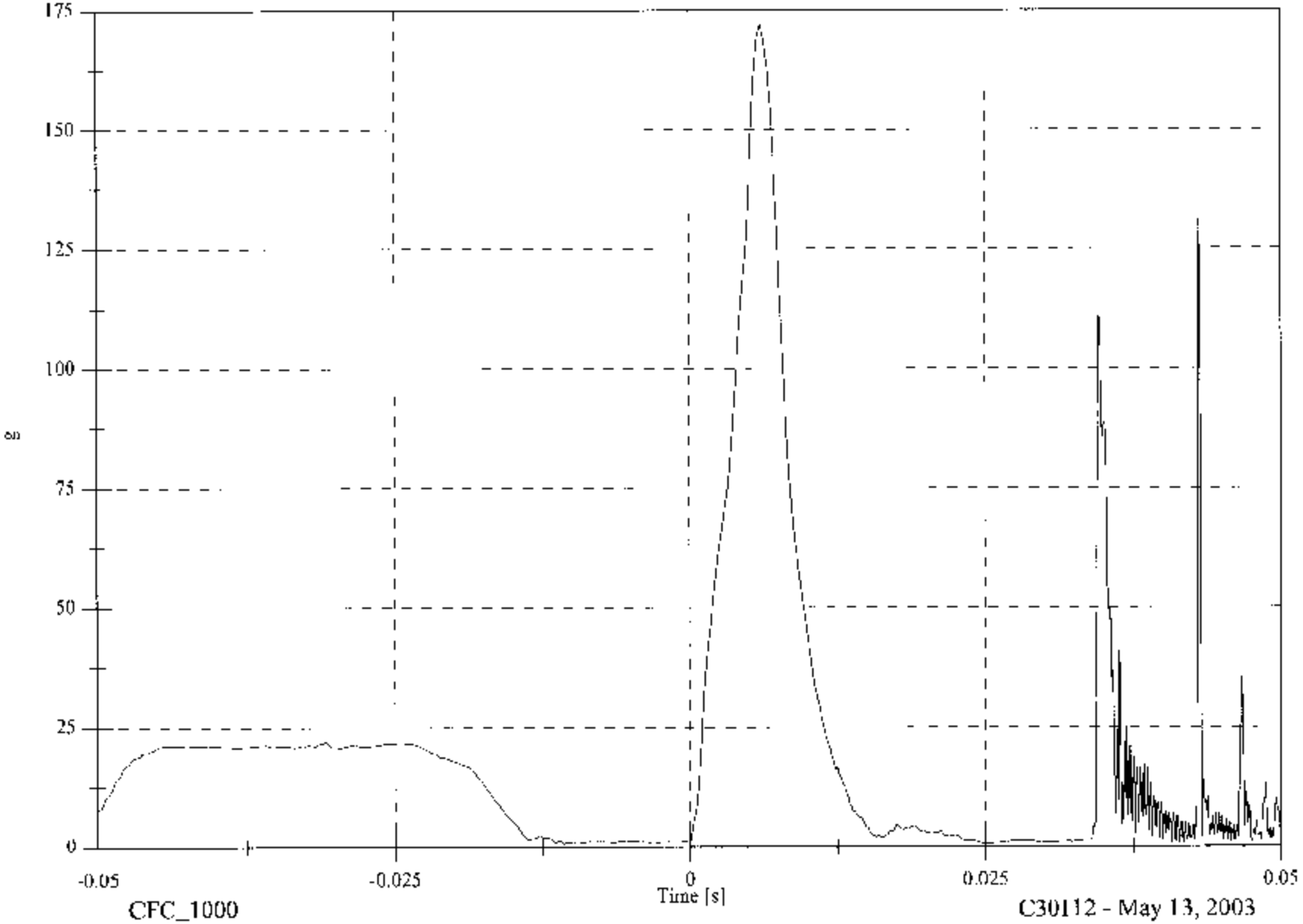
C30112 DRIVER SIDE AP3 IMPACT PLOT #4

FMH1201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Resultant

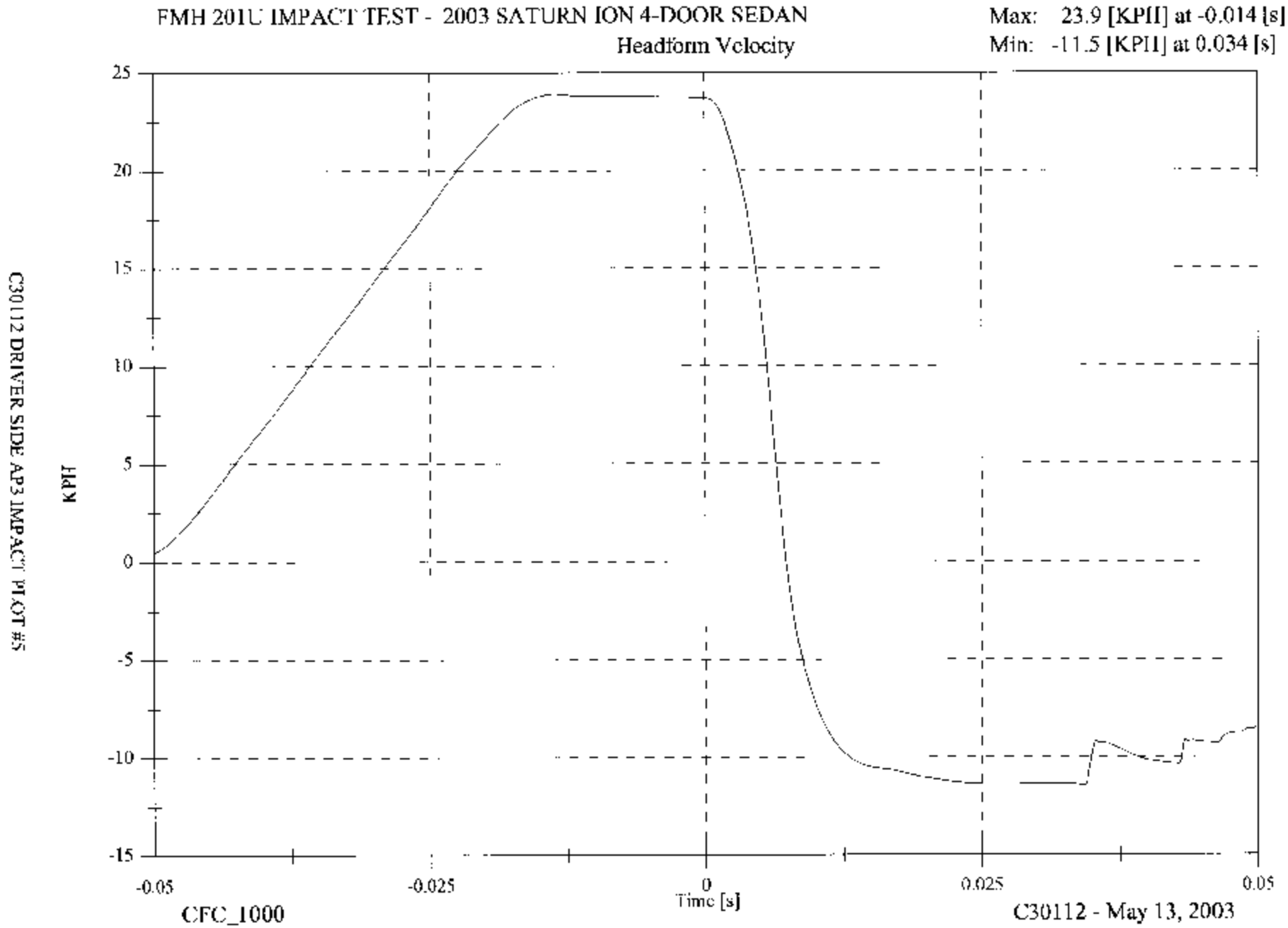
Max: 171.9 [g] at 0.006 [s]

Min: 0.4 [g] at -0.011 [s]



CFC_1000

C30112 - May 13, 2003



C30112 DRIVER SIDE AP3 IMPACT PLOT #5

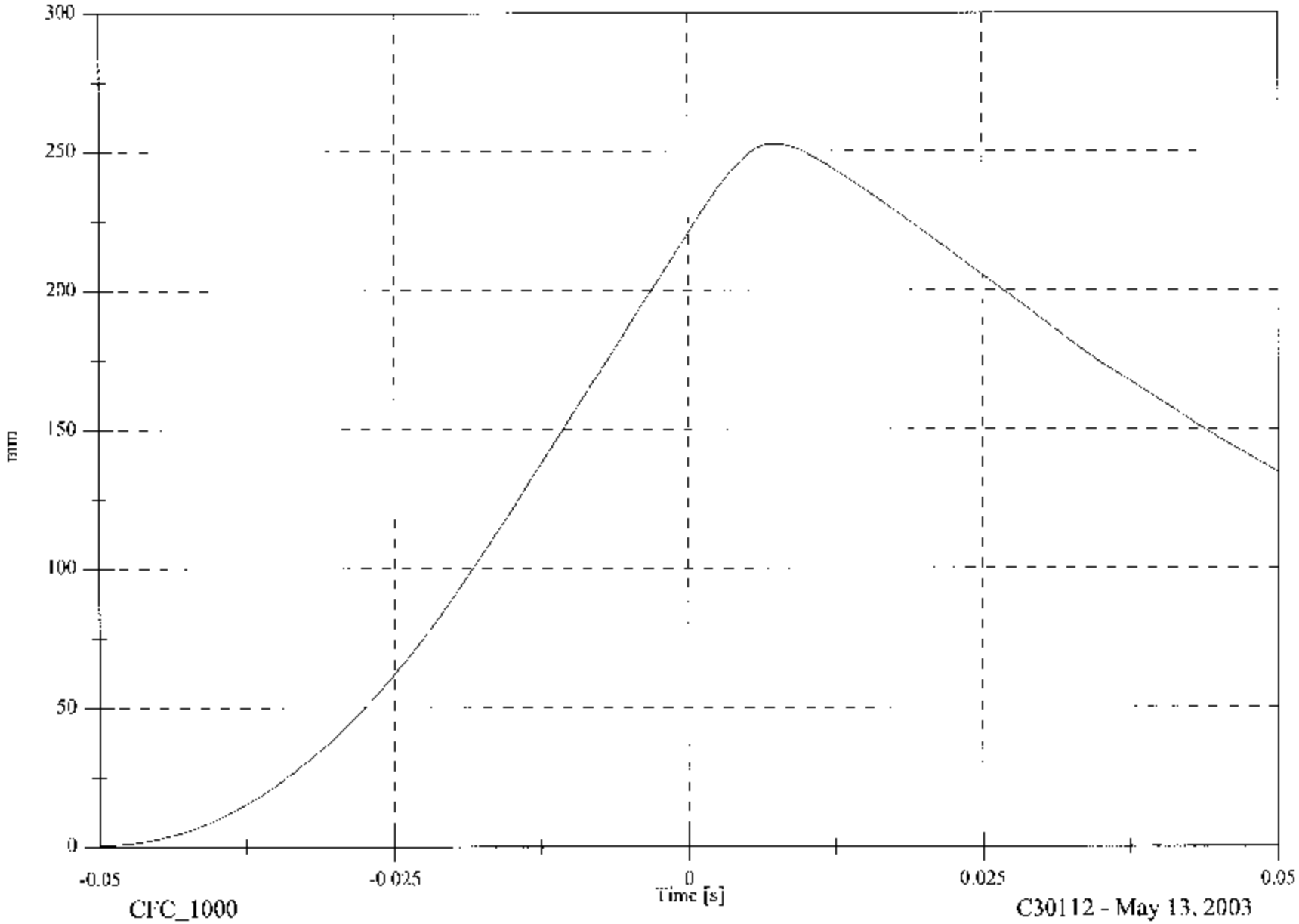
C30112 DRIVER SIDE AP3 IMPACT PLOT #6

FMH 201U IMPACT TEST - 2003 SATURN ION 4-DOOR SEDAN

Headform Displacement

Max: 252.7 [mm] at 0.007 [s]

Min: 0.6 [mm] at -0.050 [s]



CFC_1000

C30112 - May 13, 2003

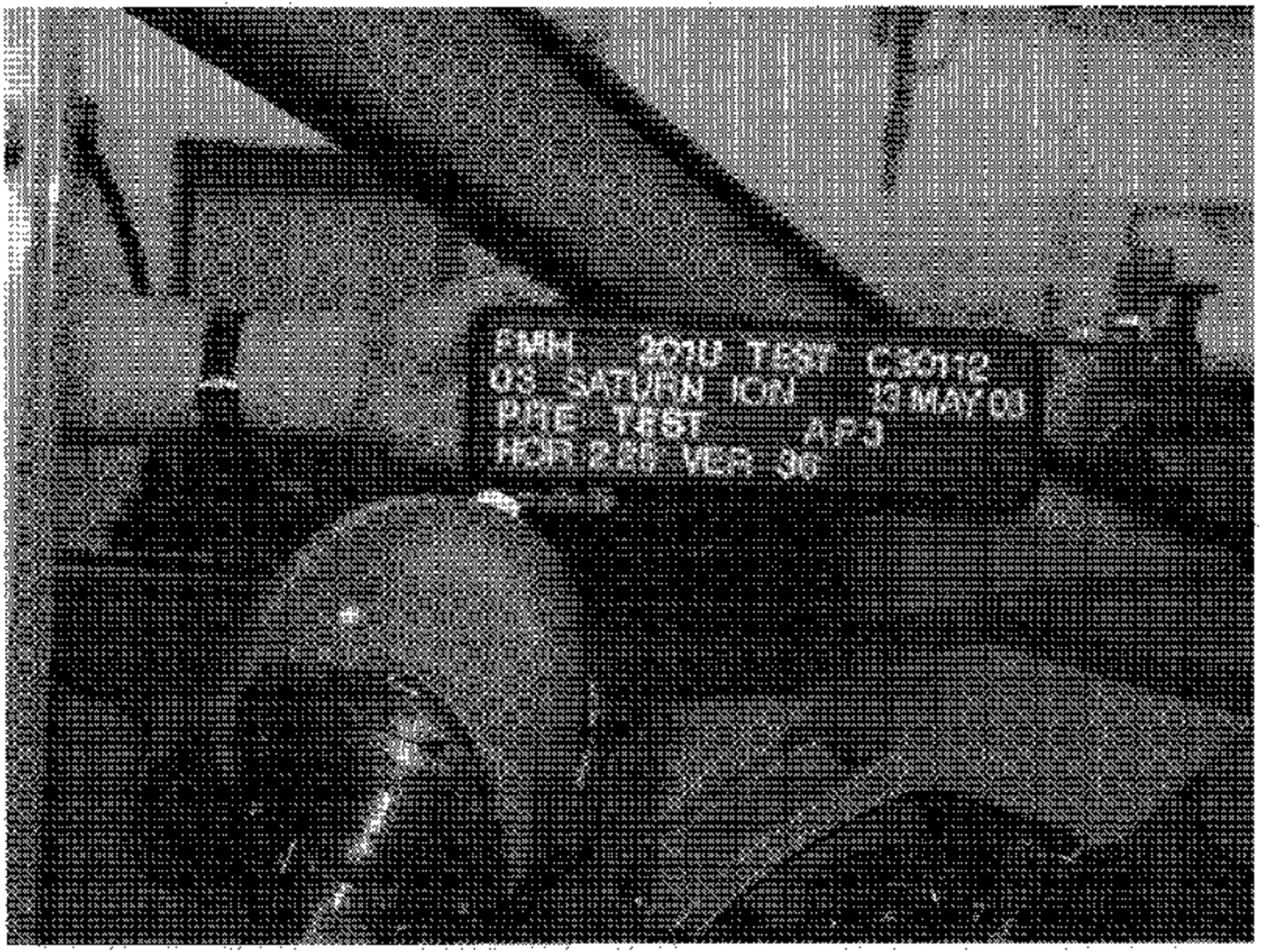


Figure : PRE-TEST AP3

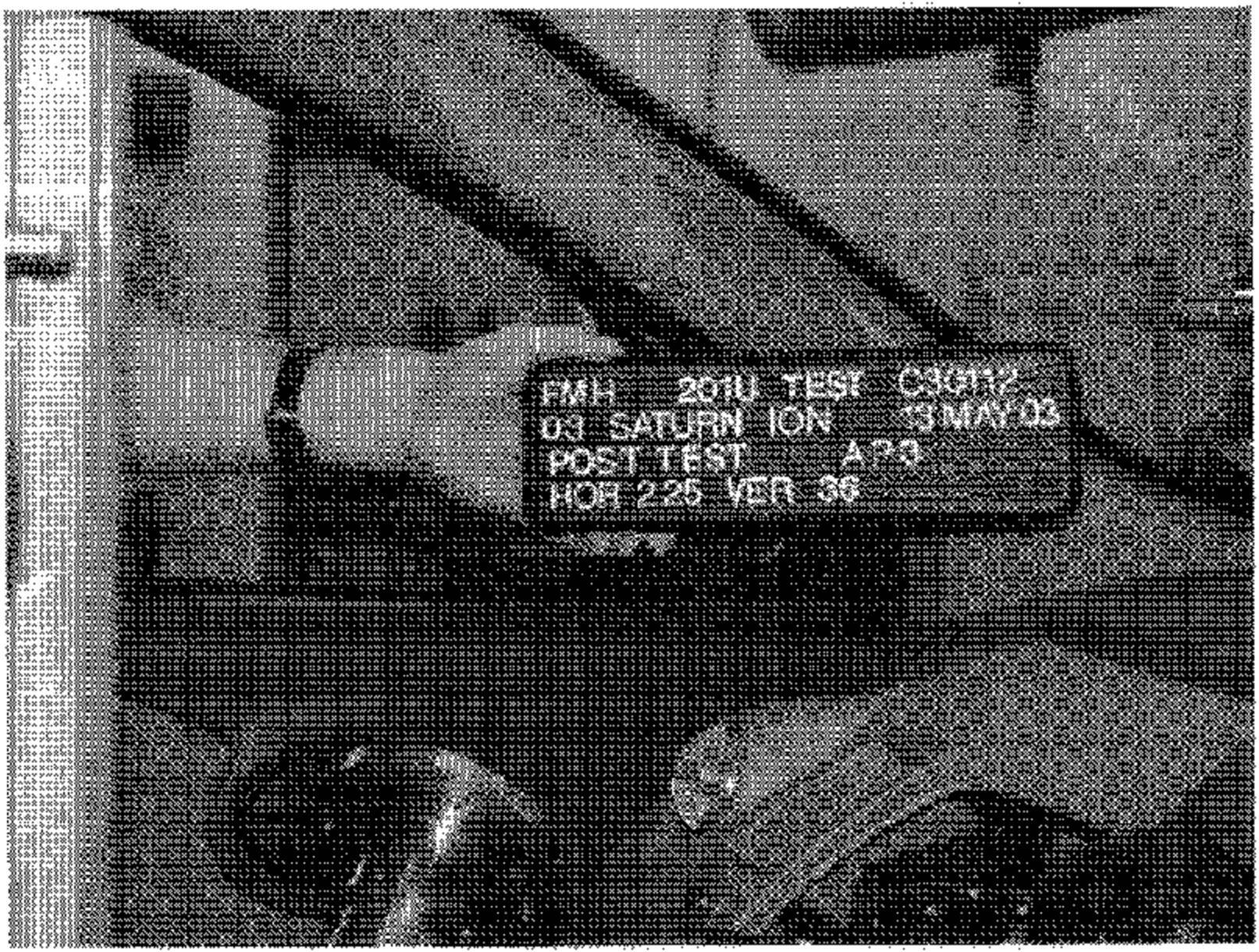
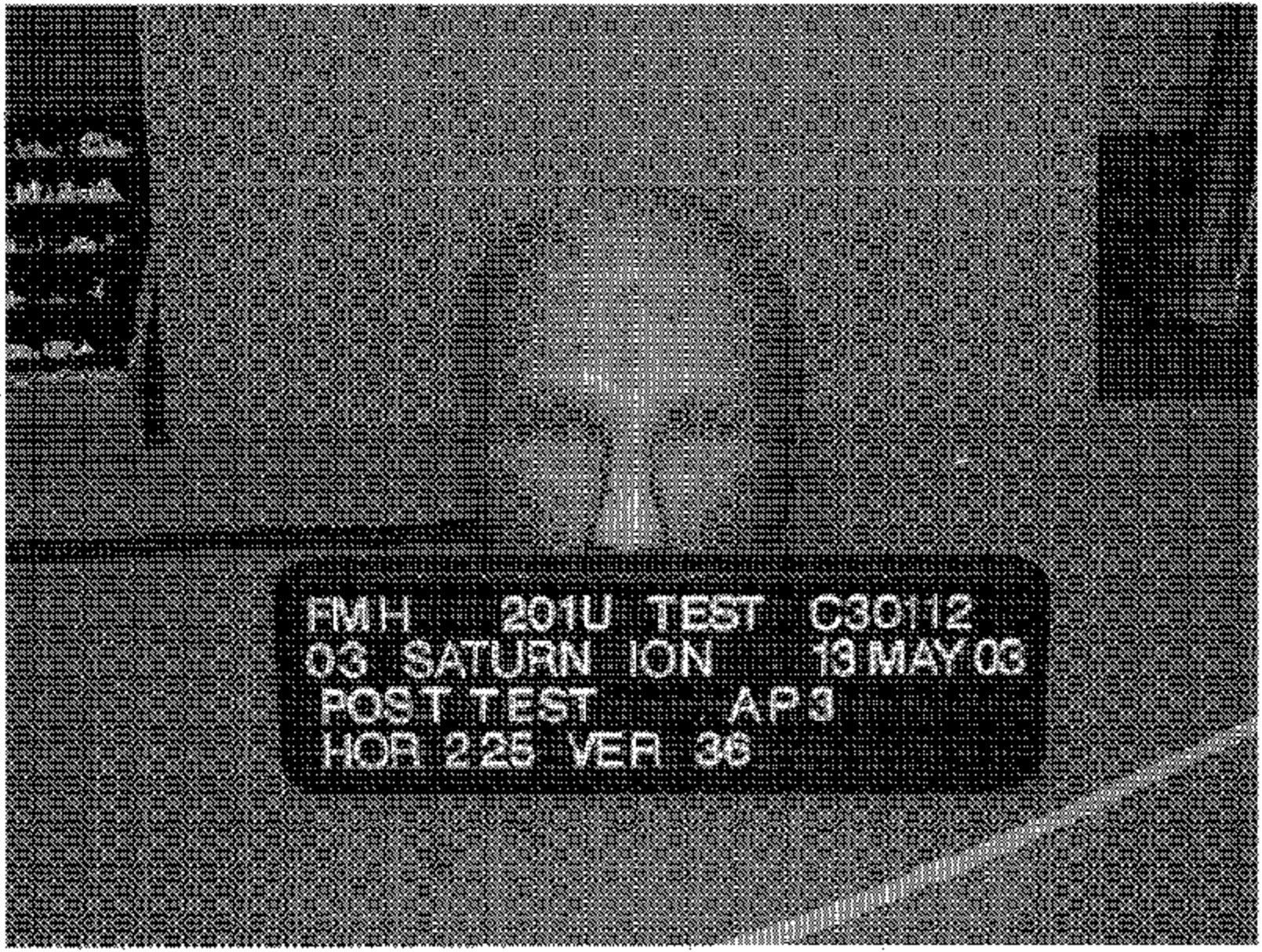


Figure : POST-TEST AP3



9650-EMH-12

Figure : APS HEADFORM

APPENDIX A

PHOTOGRAPHS

PHOTOGRAPHS

FIGURE	VIEW
A-1	LEFT SIDE VIEW OF VEHICLE
A-2	RIGHT SIDE VIEW OF VEHICLE
A-3	3/4 FRONTAL VIEW FROM LEFT SIDE OF VEHICLE
A-4	3/4 REAR VIEW FROM RIGHT SIDE OF VEHICLE
A-5	VEHICLES CERTIFICATION LABEL
A-6	VEHICLES TIRE INFORMATION LABEL
A-7	PRE-TEST DRIVER SIDE A-PILLAR
A-8	PRE-TEST DRIVER SIDE FRONT HEADER
A-9	PRE-TEST DRIVER SIDE SIDE RAIL
A-10	PRE-TEST DRIVER SIDE B-PILLAR
A-11	PRE-TEST DRIVER SIDE REAR PILLAR
A-12	PRE-TEST PASSENGER SIDE A-PILLAR
A-13	PRE-TEST PASSENGER SIDE FRONT HEADER
A-14	PRE-TEST PASSENGER SIDE SIDE RAIL
A-15	PRE-TEST PASSENGER SIDE B-PILLAR
A-16	PRE-TEST PASSENGER SIDE REAR PILLAR
A-17	POST-TEST DRIVER SIDE A-PILLAR
A-18	POST-TEST DRIVER SIDE FRONT HEADER
A-19	POST-TEST DRIVER SIDE SIDE RAIL
A-20	POST-TEST DRIVER SIDE B-PILLAR
A-21	POST-TEST DRIVER SIDE REAR PILLAR
A-22	POST-TEST PASSENGER SIDE A-PILLAR
A-23	POST-TEST PASSENGER SIDE FRONT HEADER
A-24	POST-TEST PASSENGER SIDE SIDE RAIL
A-25	POST-TEST PASSENGER SIDE B-PILLAR
A-26	POST-TEST PASSENGER SIDE REAR PILLAR

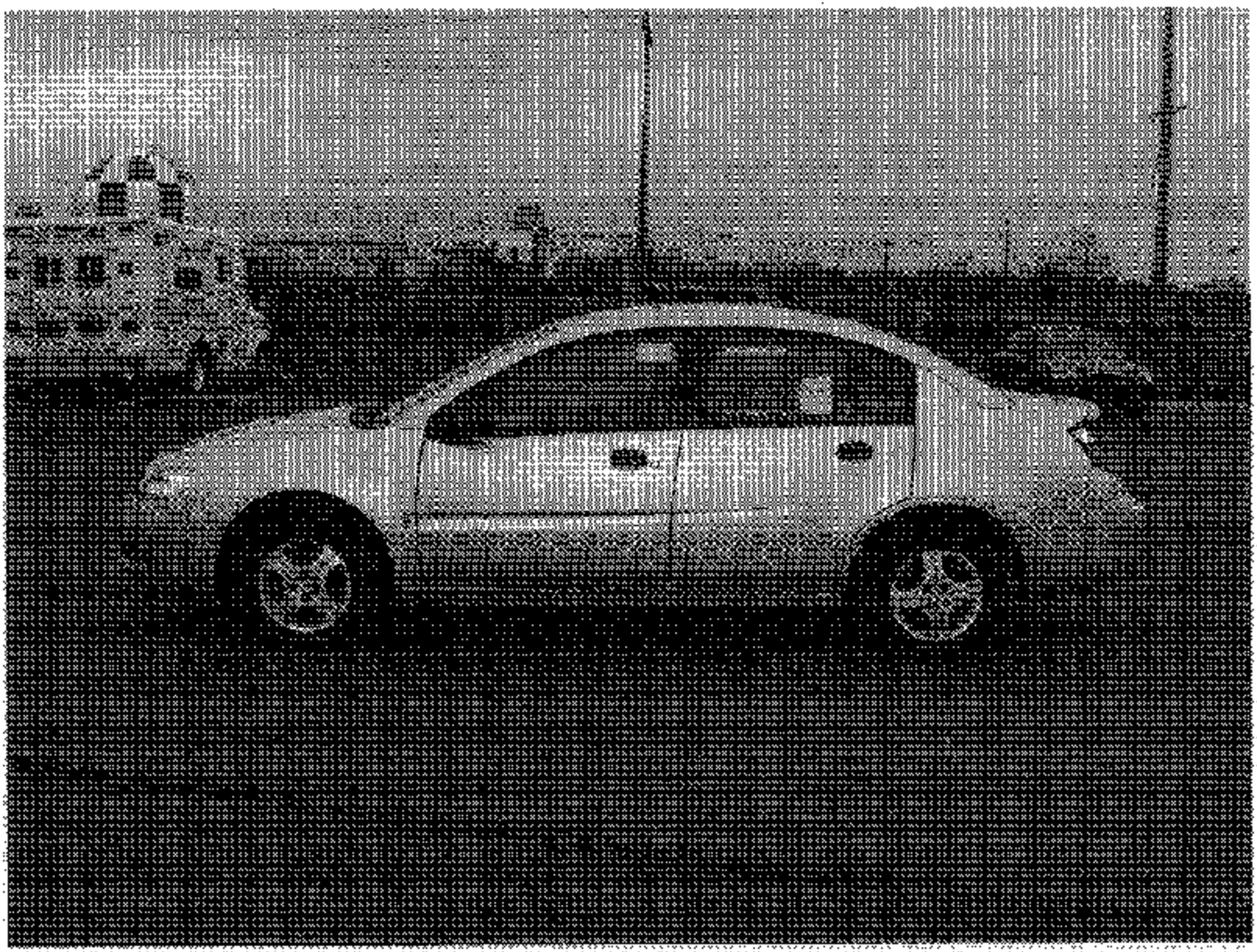


Figure A-1 : LEFT SIDE VIEW OF VEHICLE

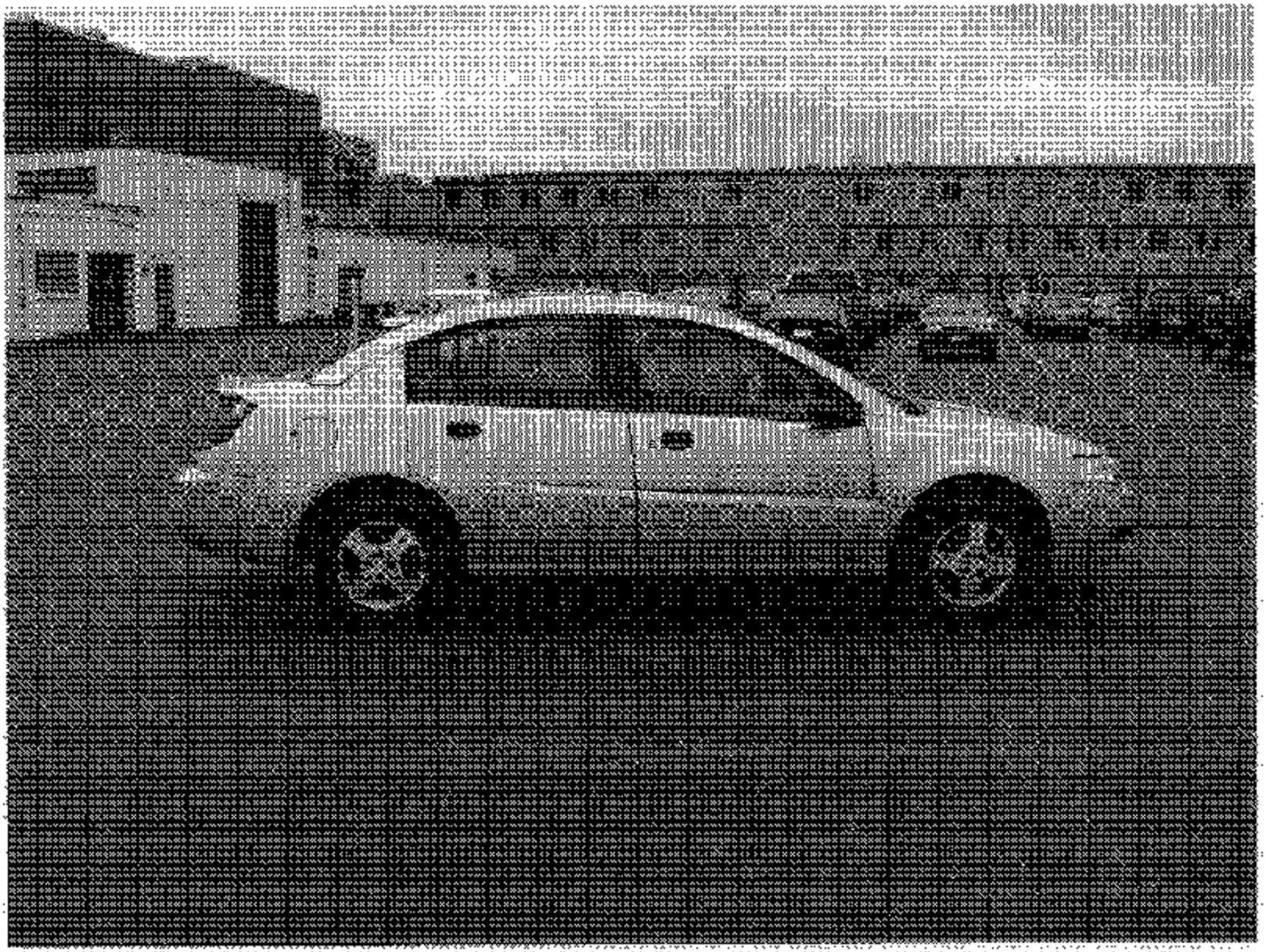


Figure A-2 : RIGHT SIDE VIEW OF VEHICLE

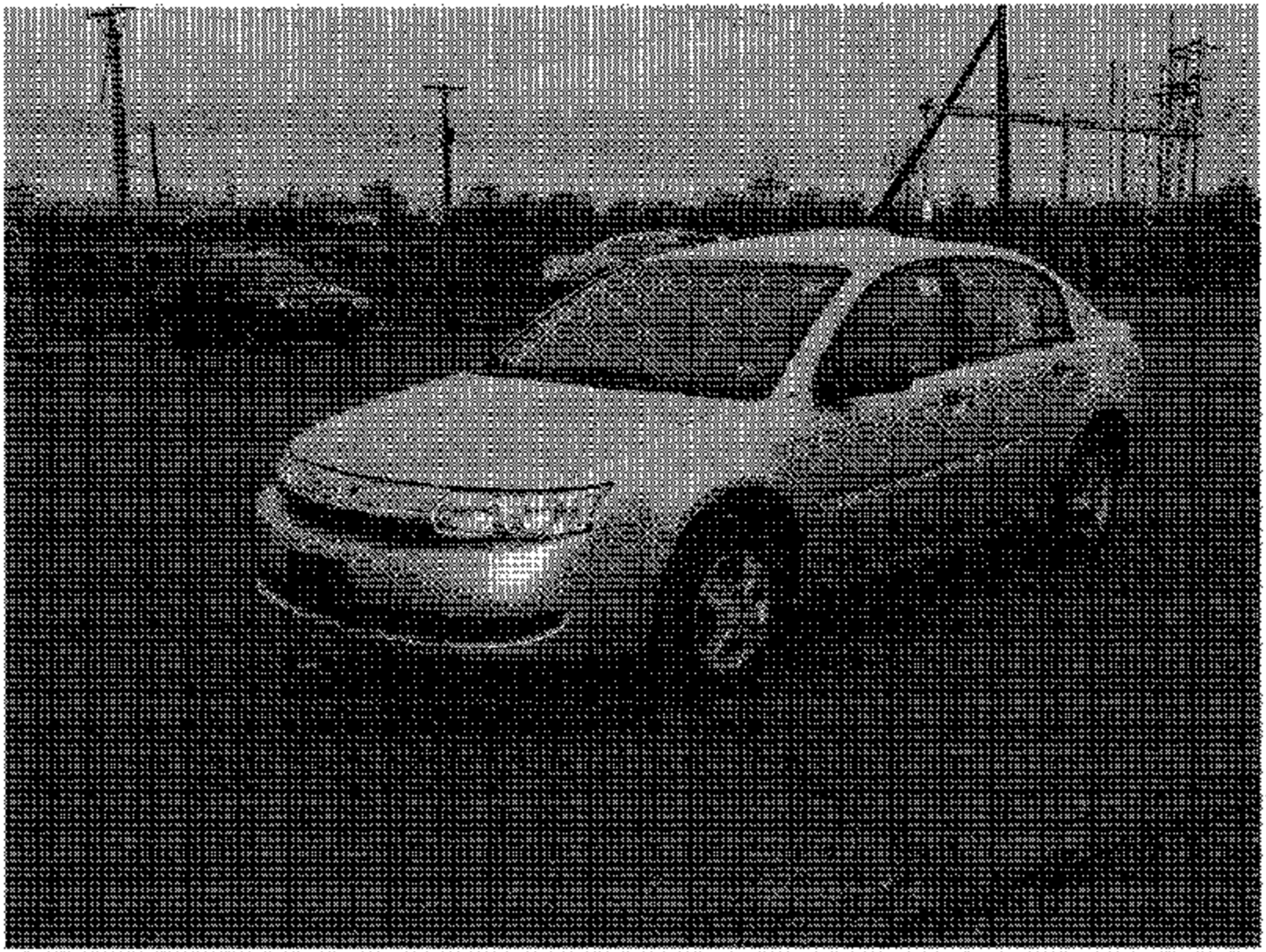


Figure A-3 : 3/4 FRONTAL VIEW FROM LEFT SIDE OF VEHICLE

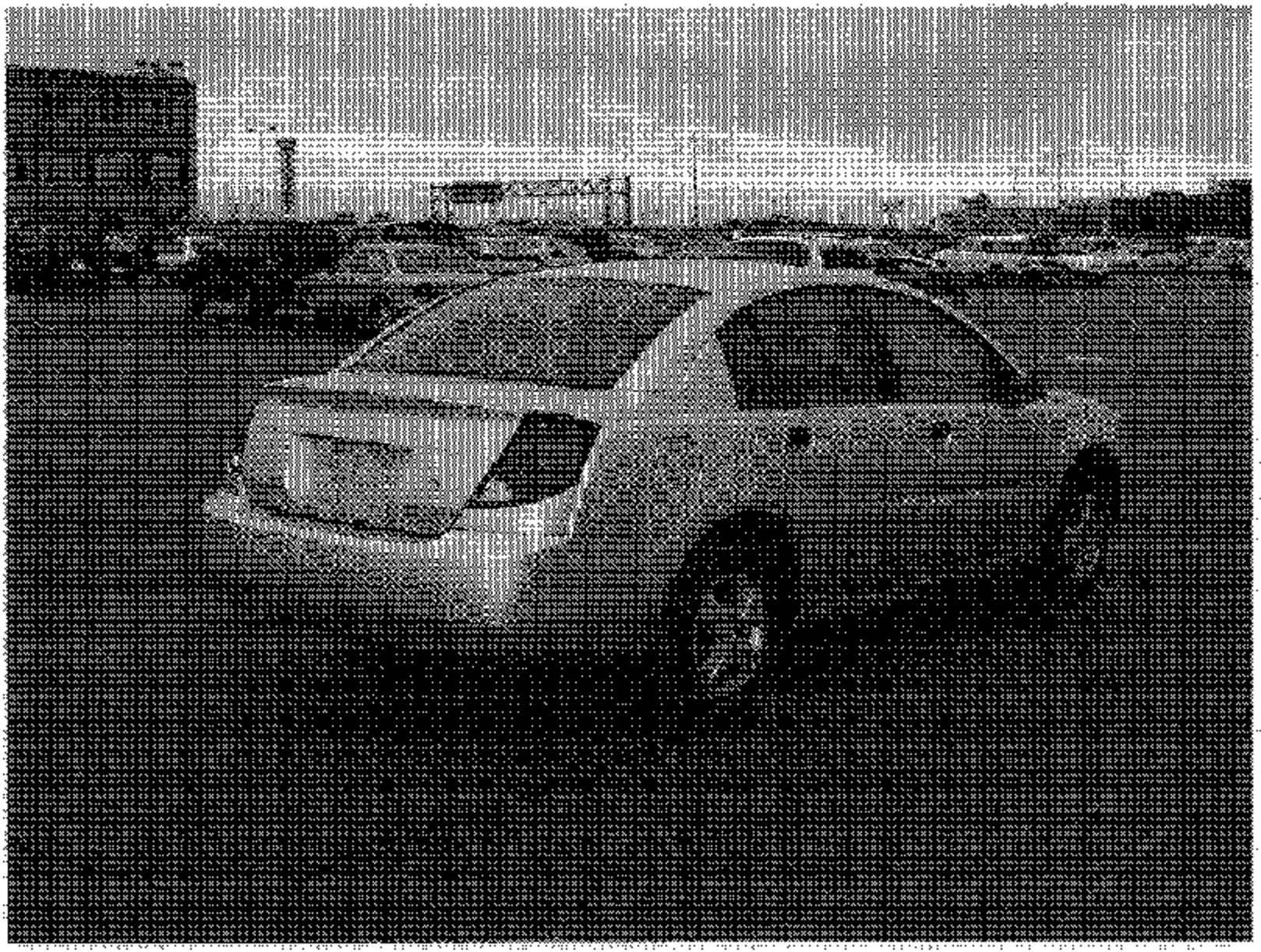


Figure A-4 : 3/4 REAR VIEW FROM RIGHT SIDE OF VEHICLE

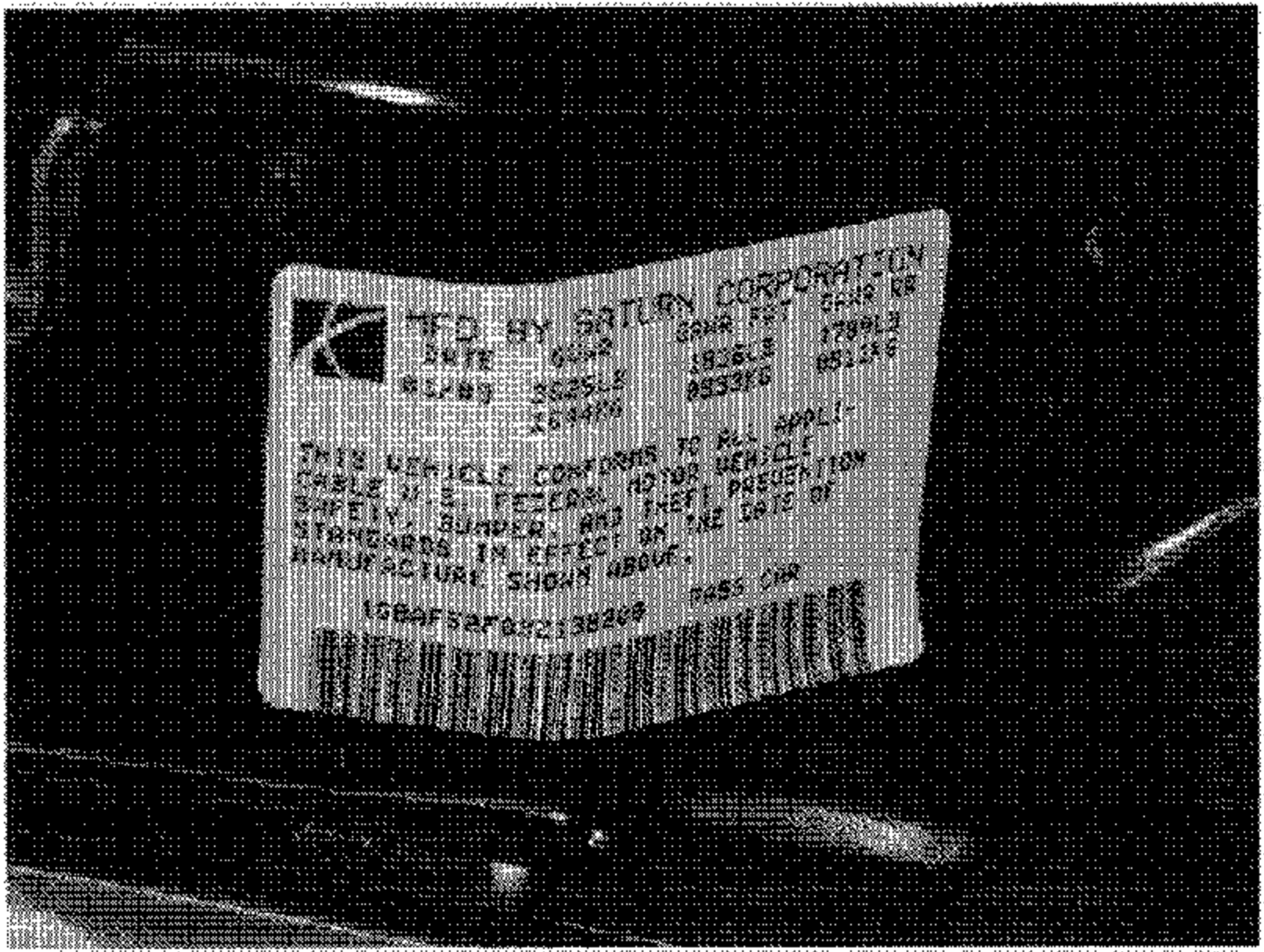


Figure A-5 : VEHICLE'S CERTIFICATION LABEL

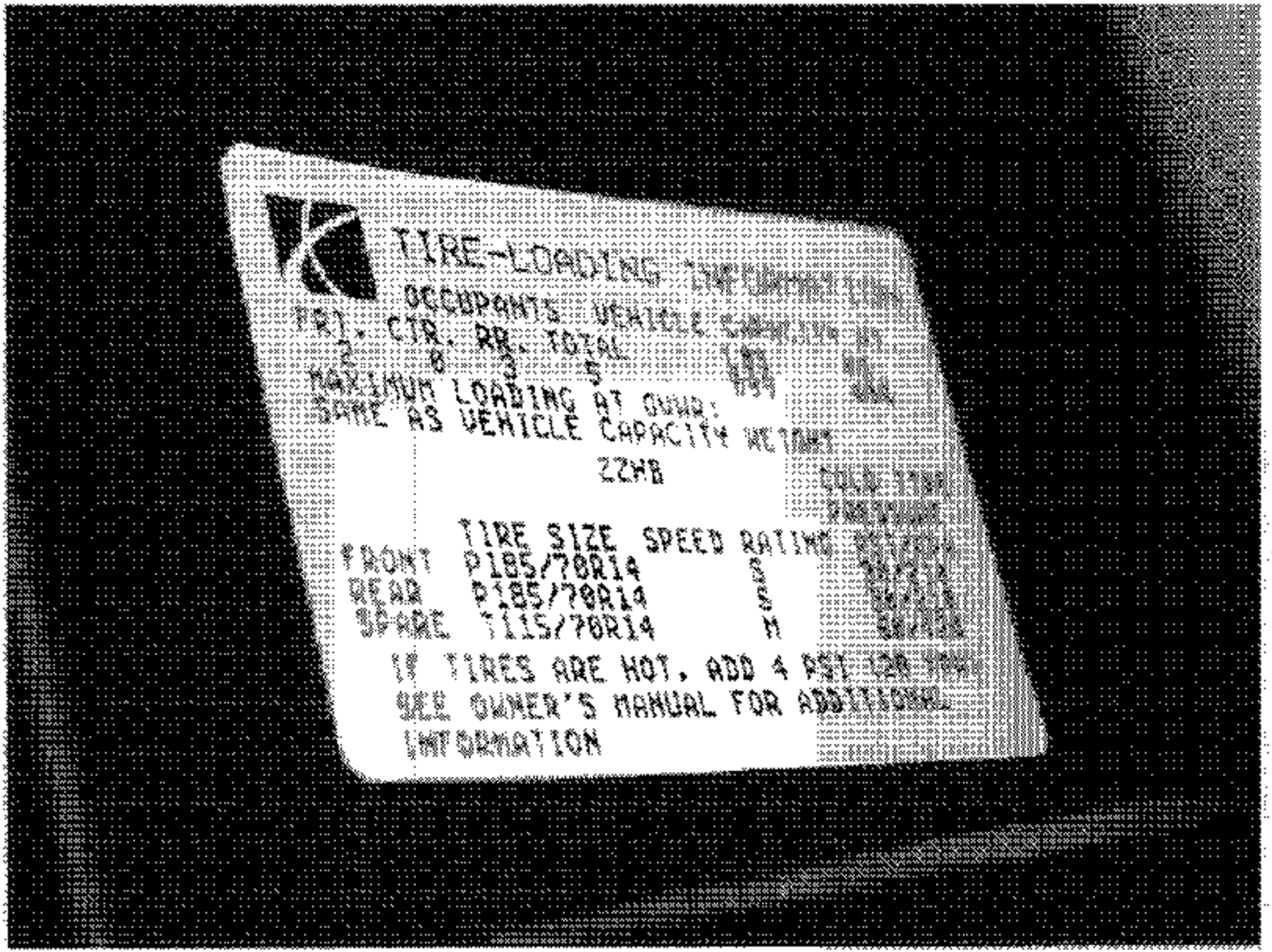


Figure A-6 : VEHICLE'S TIRE INFORMATION LABEL

Figure A-7: PRE-TEST DRIVER SIDE A-PILLAR

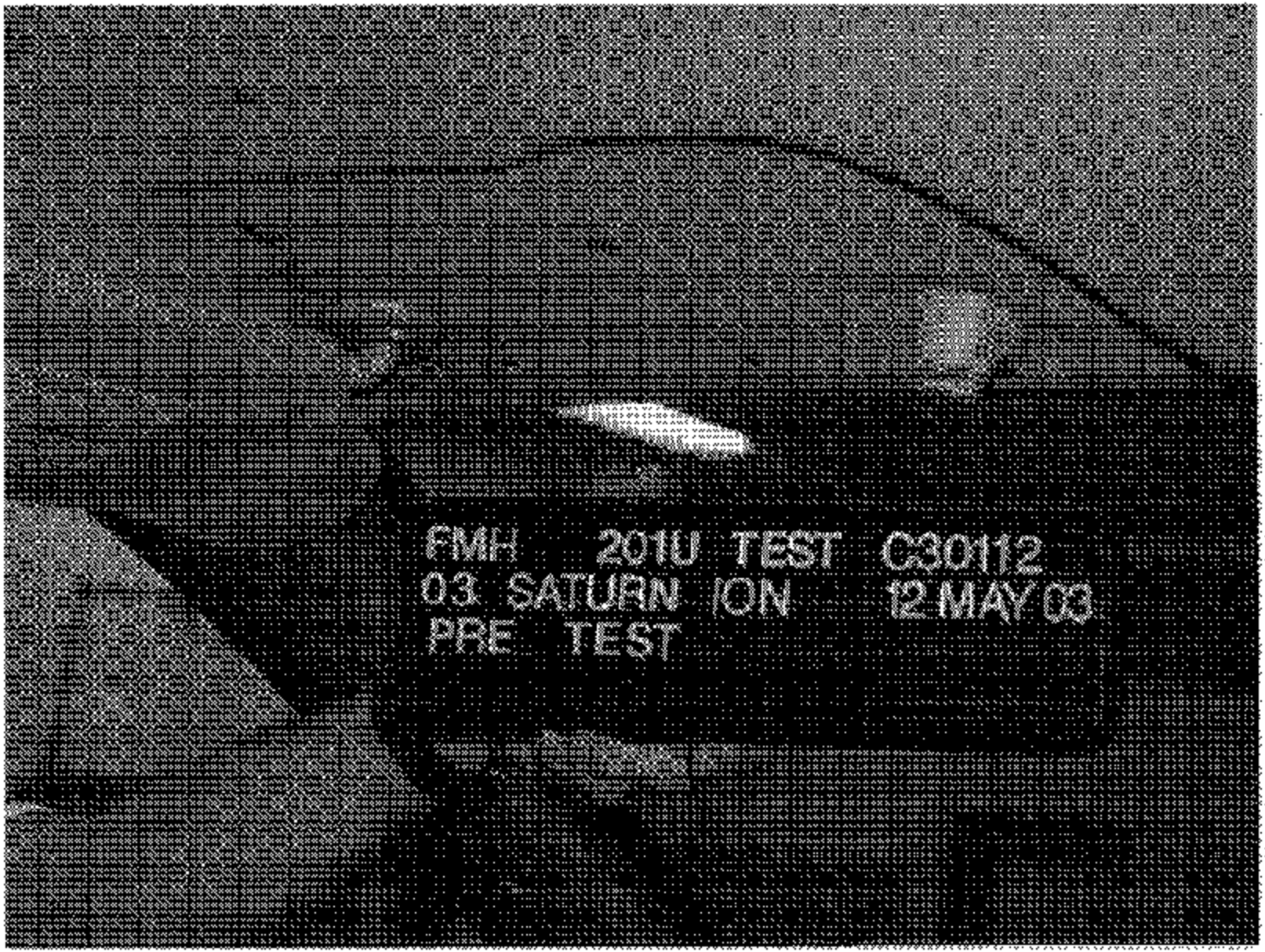


Figure A-8 : PRE-TEST DRIVER SIDE FRONT HEADER

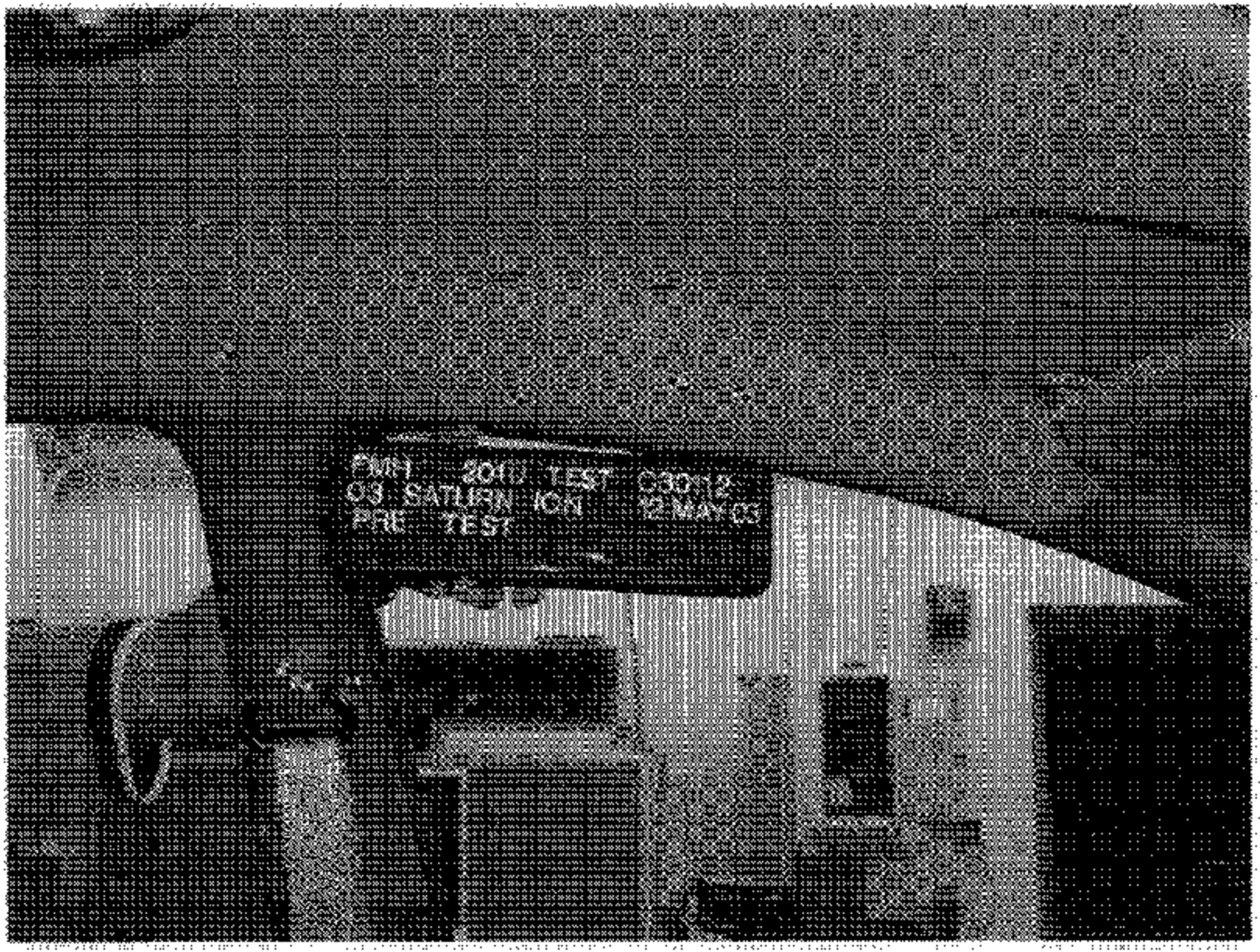


Figure A-9 : PRE-TEST DRIVER SIDE SIDE RAIL

Figure A-10 : PRE-TEST DRIVER SIDE B-PILLAR

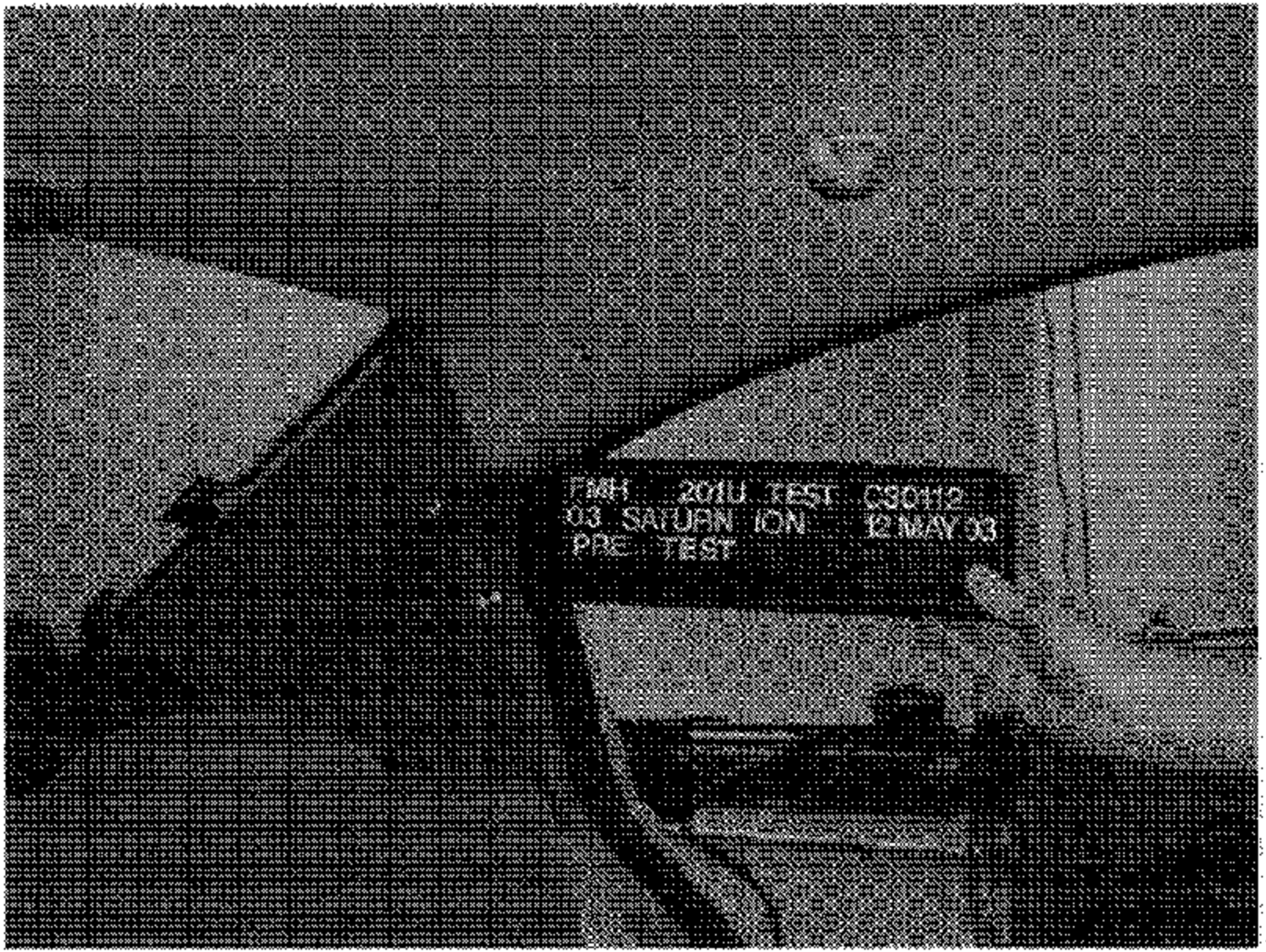


Figure A-11 : PRE-TEST DRIVER SIDE REAR PILLAR

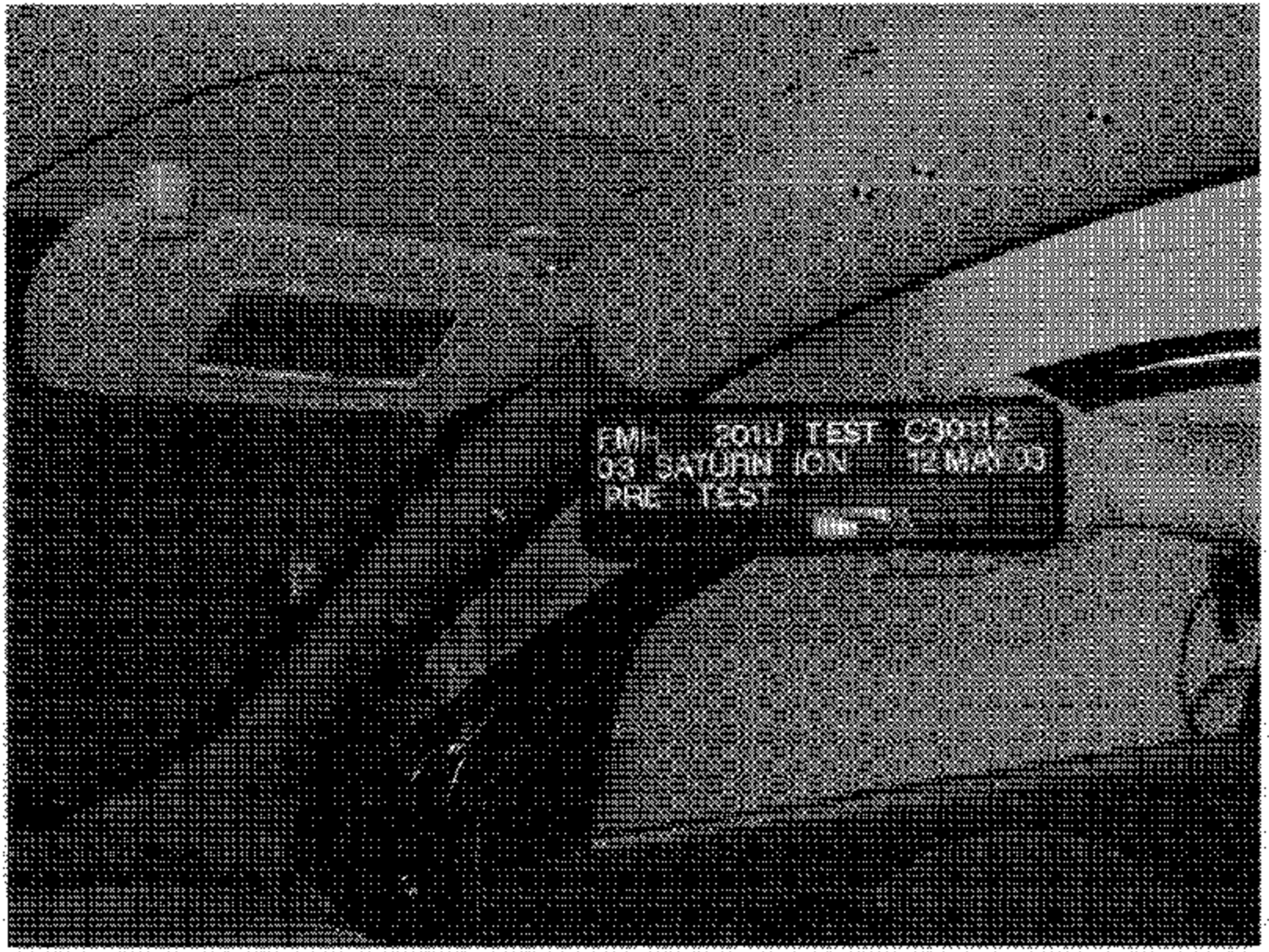


Figure A-12 : PRE-TEST PASSENGER SIDE A-PILLAR

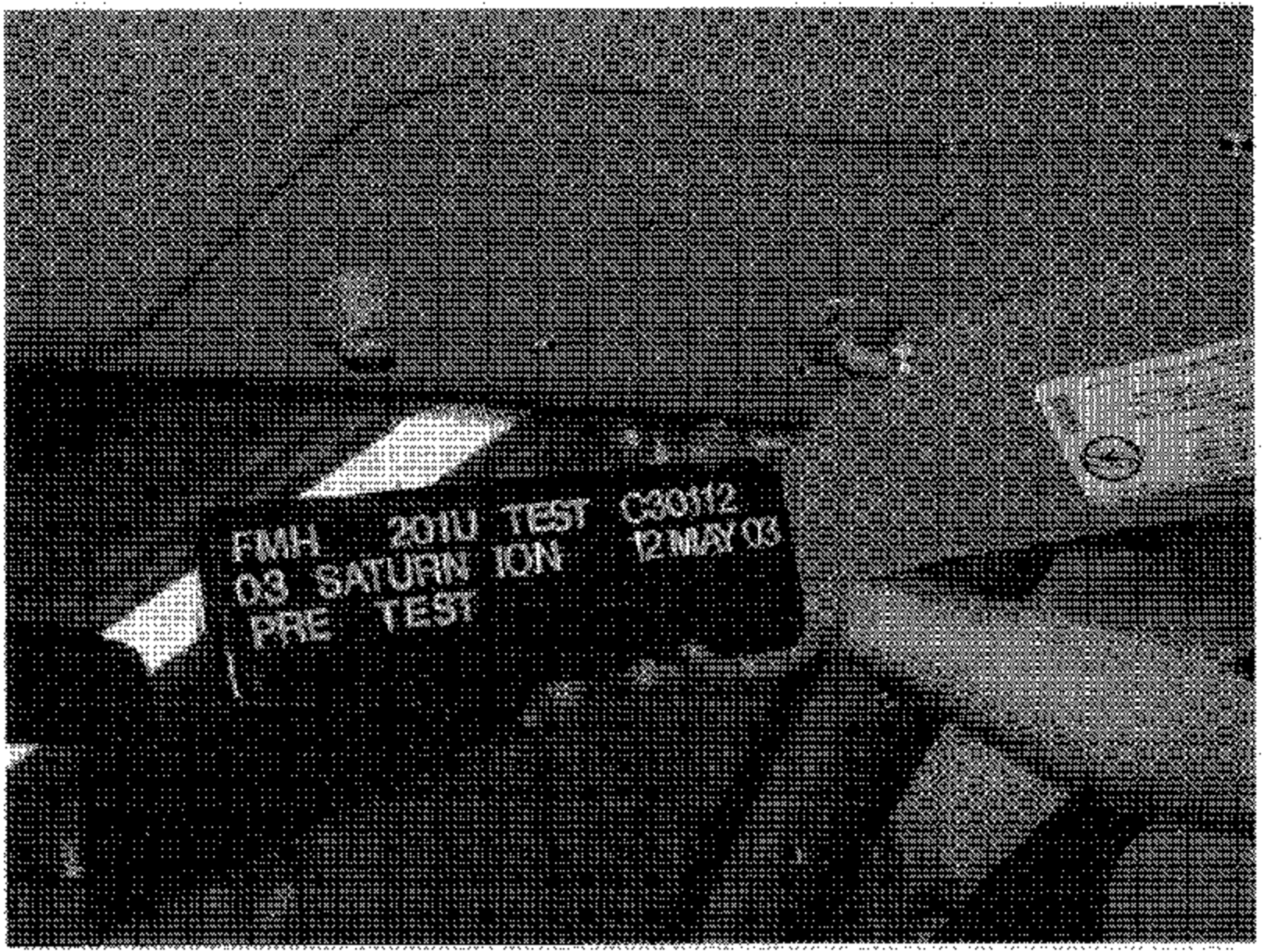


Figure A-13 : PRE-TEST PASSENGER SIDE FRONT HEADER

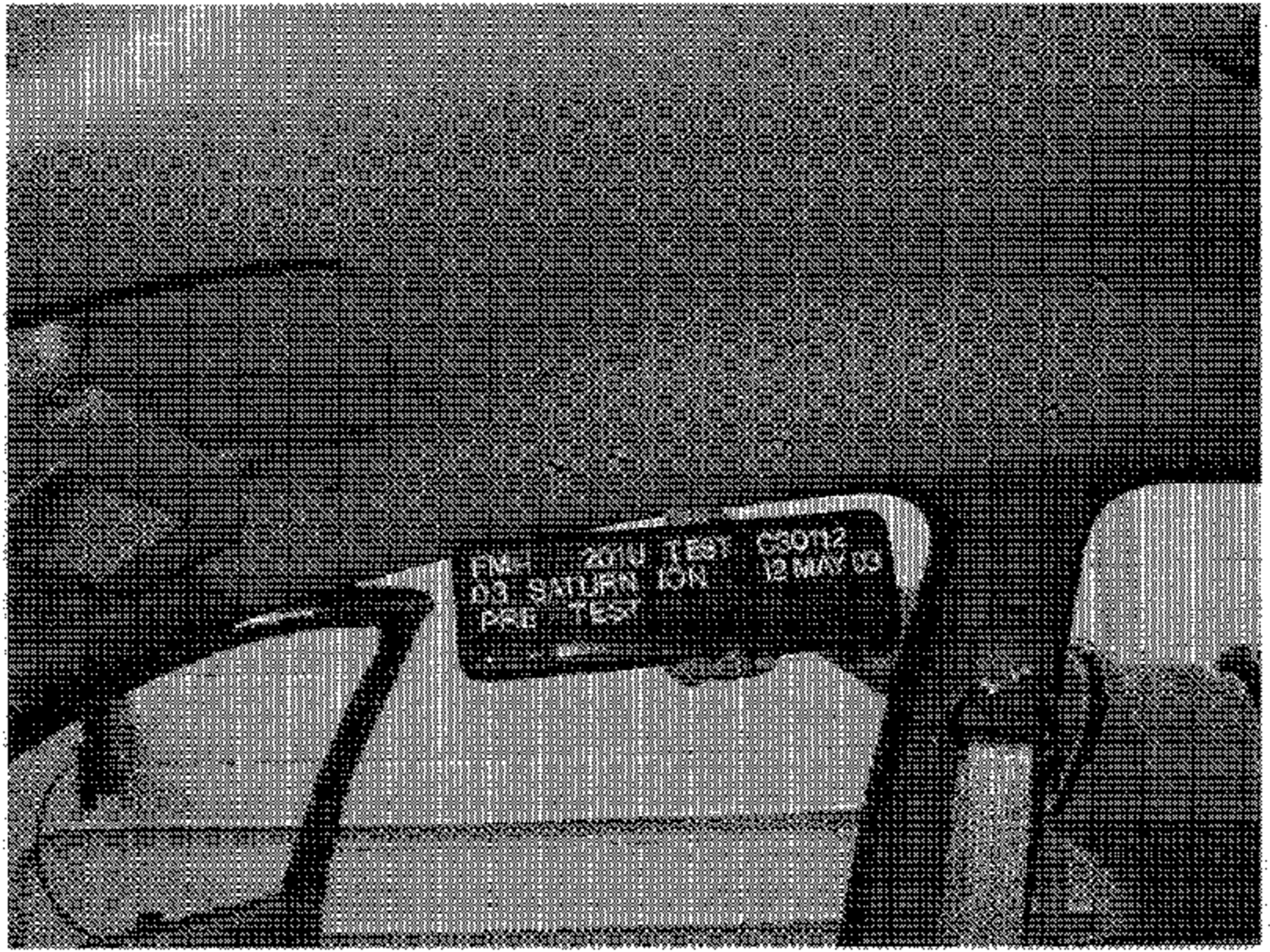


Figure A-14 : PRE-TEST PASSENGER SIDE SIDE RAIL

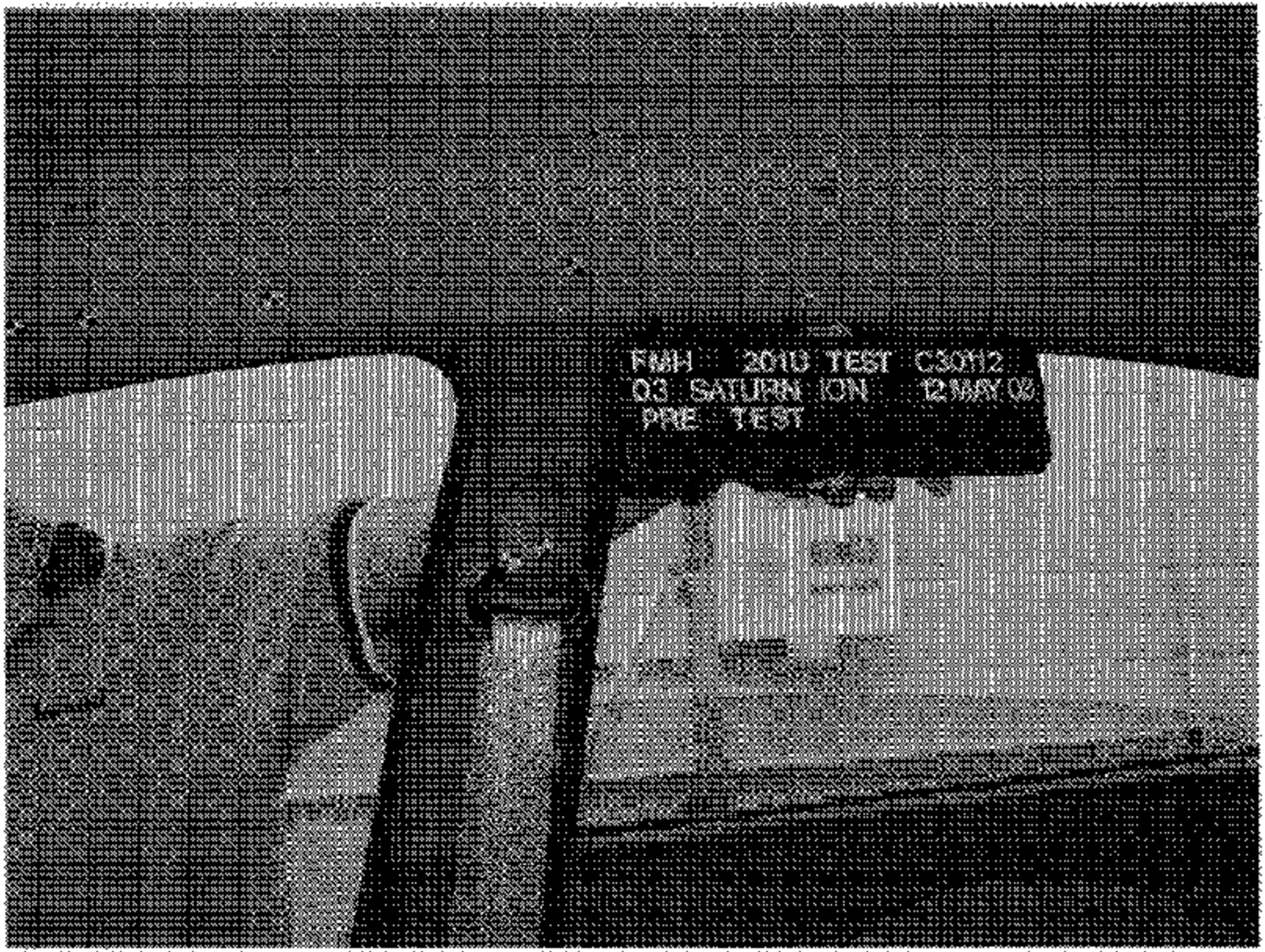


Figure A-15 : PRE-TEST PASSENGER SIDE B-PILLAR

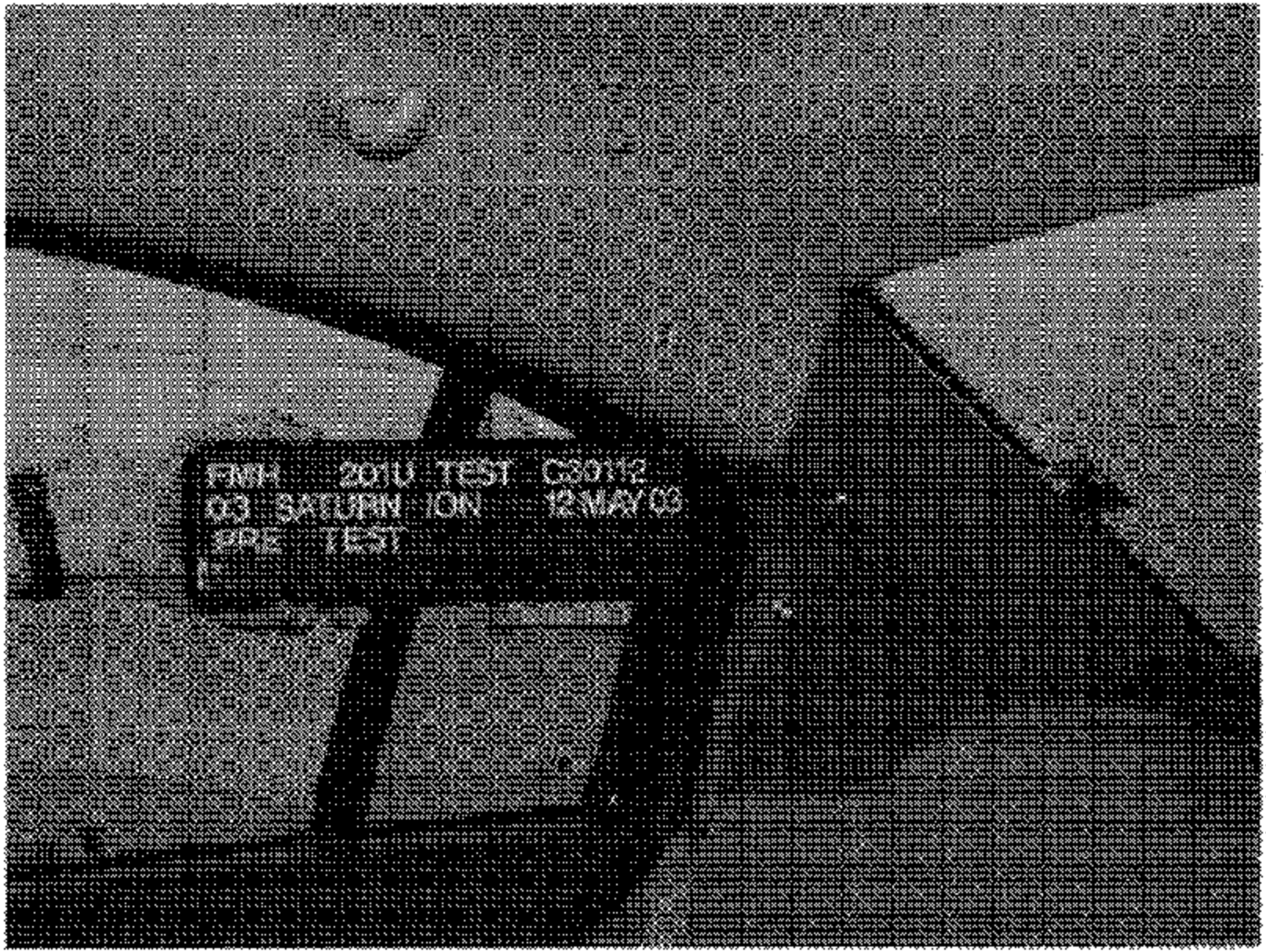


Figure A-16 : PRE-TEST PASSENGER SIDE REAR PILLAR

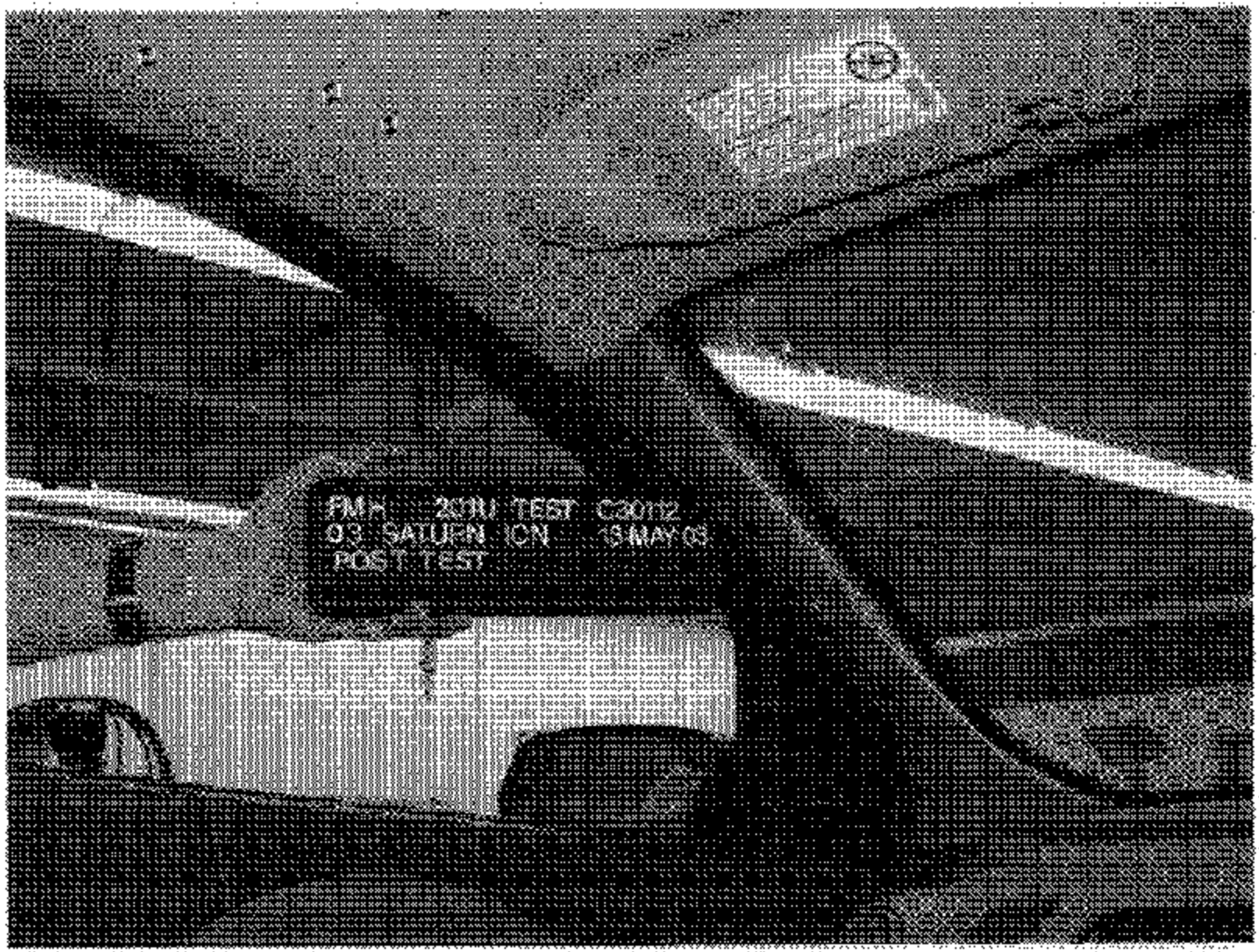


Figure A-17: POST-TEST DRIVER SIDE A-PILLAR

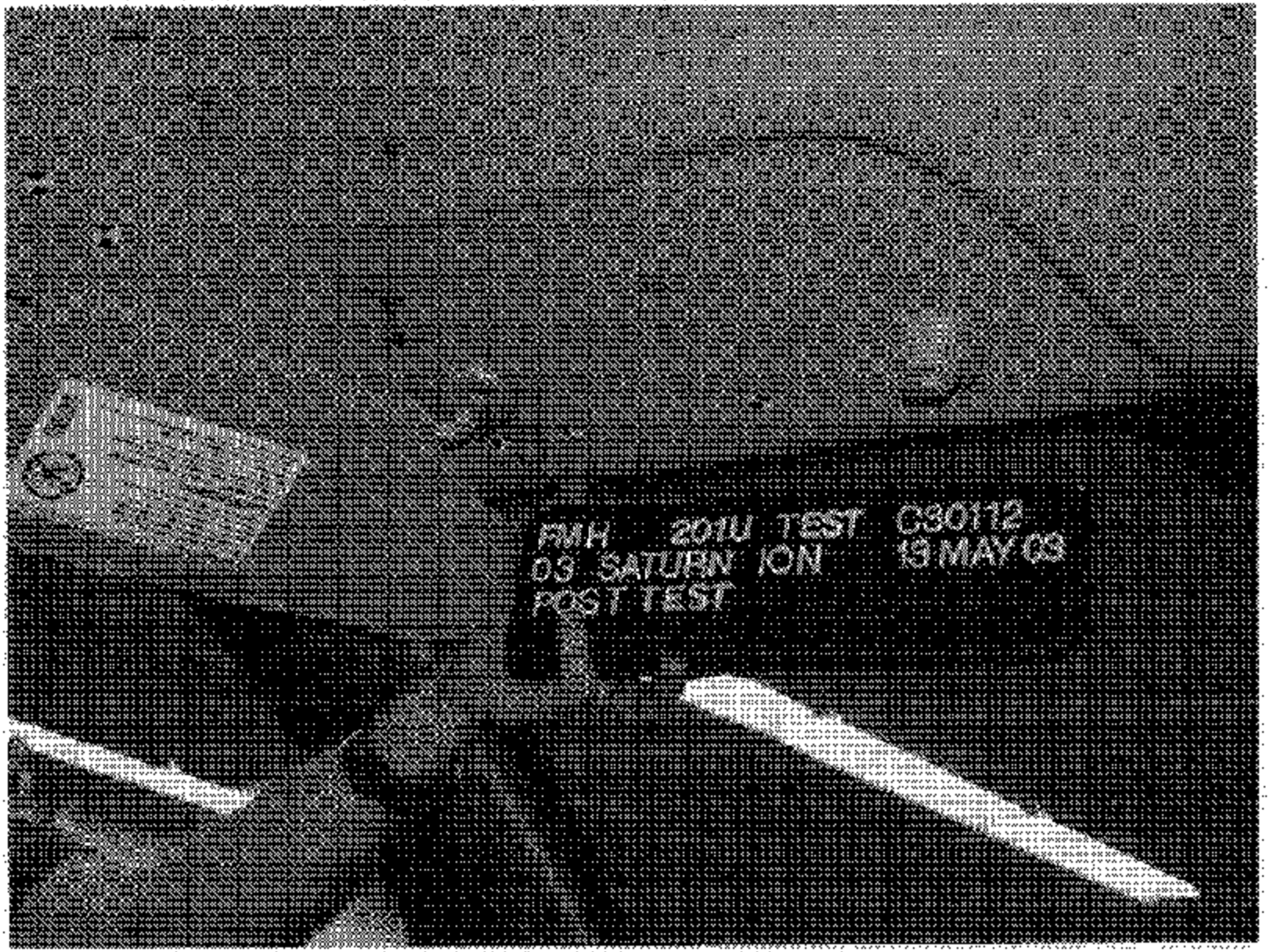


Figure A-18 : POST-TEST DRIVER SIDE FRONT HEADER

Figure A-19: POST-TEST DRIVER SIDE SIDE RAIL

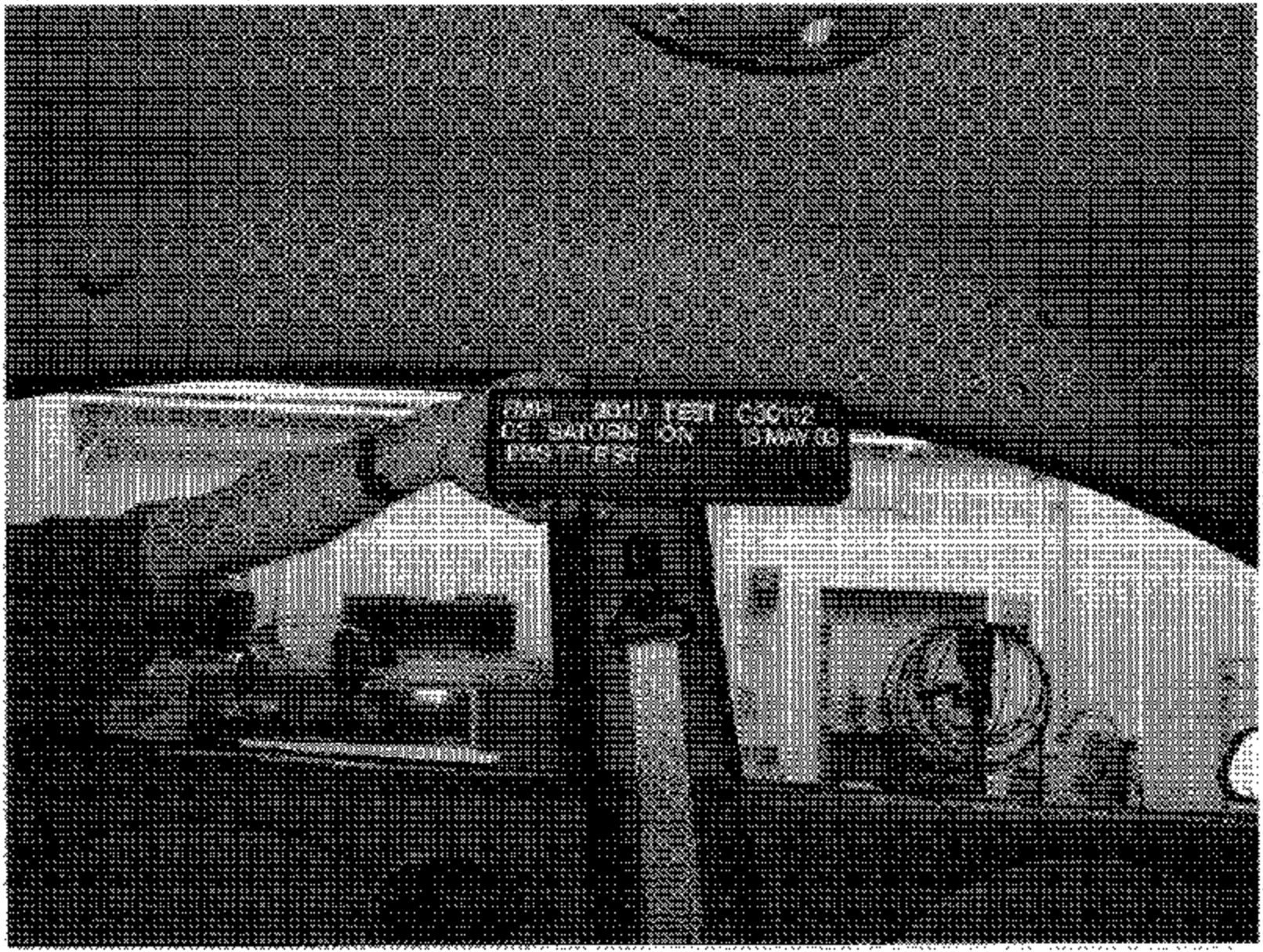


Figure A-20 : POST-TEST DRIVER SIDE B-PILLAR

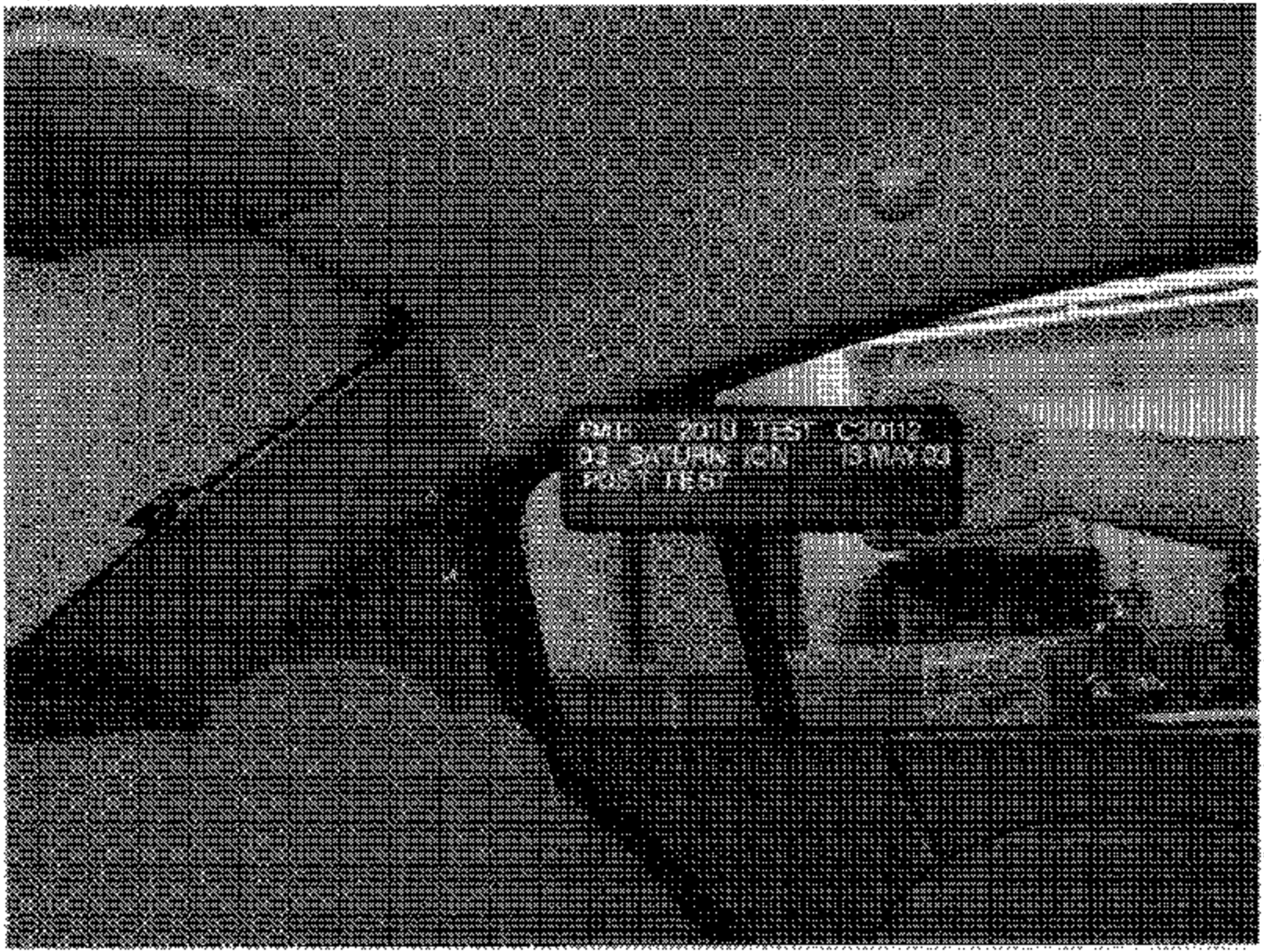


Figure A-21 ; POST-TEST DRIVER SIDE REAR PILLAR

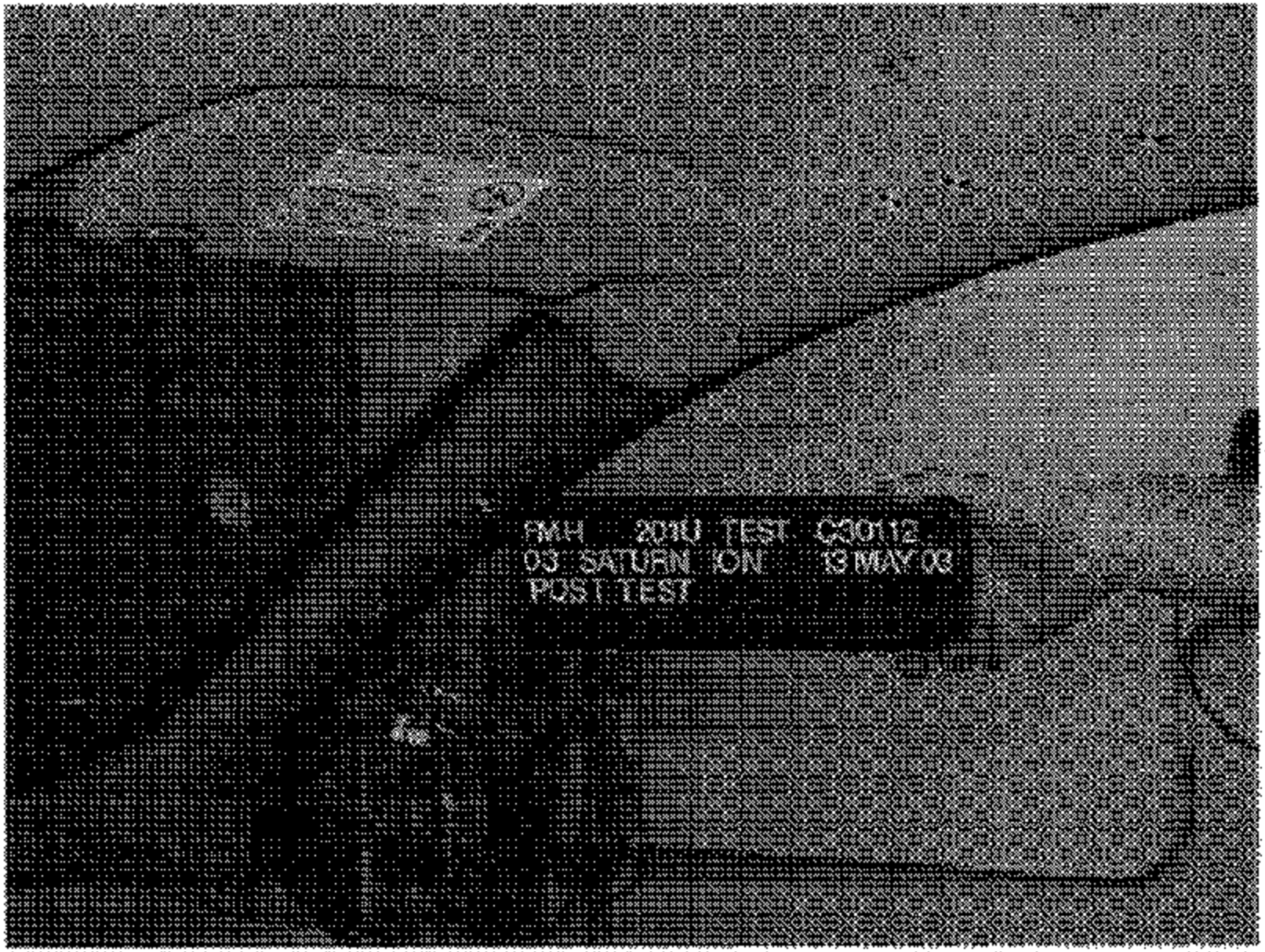


Figure A-22 : POST-TEST PASSENGER SIDE A-PILLAR

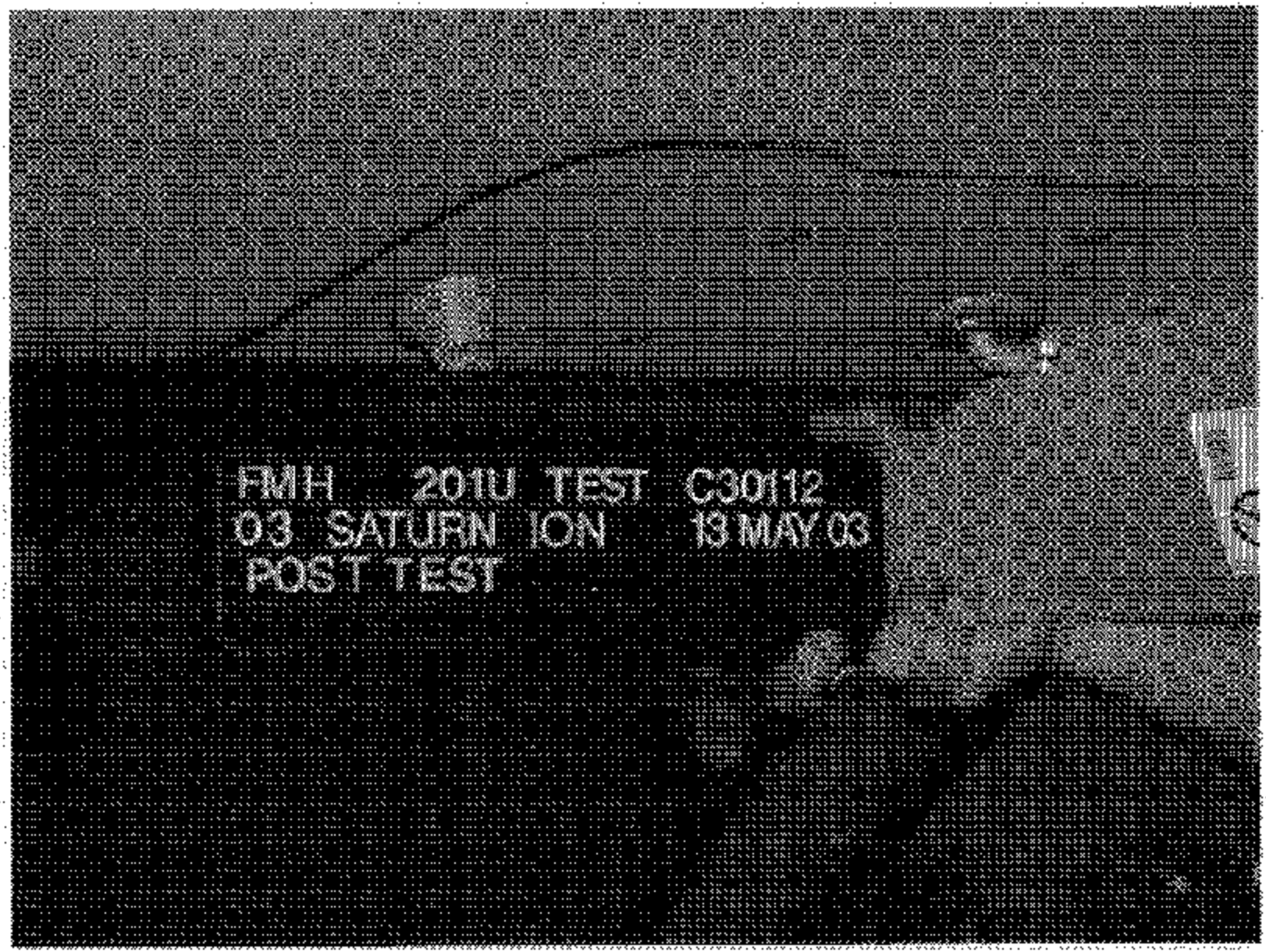


Figure A-23: POST-TEST PASSENGER SIDE FRONT HEADER

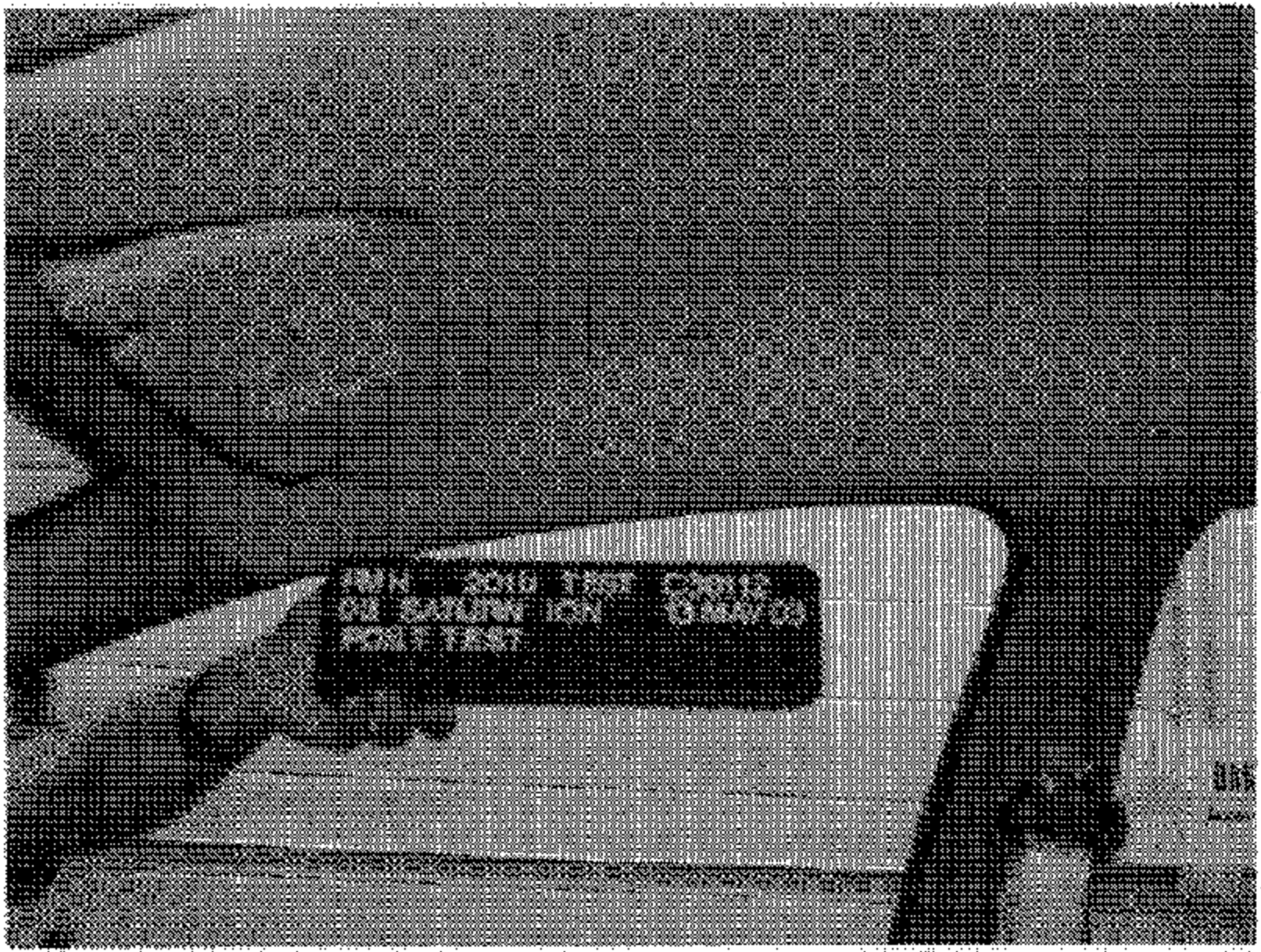


Figure A-24 : POST-TEST PASSENGER SIDE SIDE RAIL

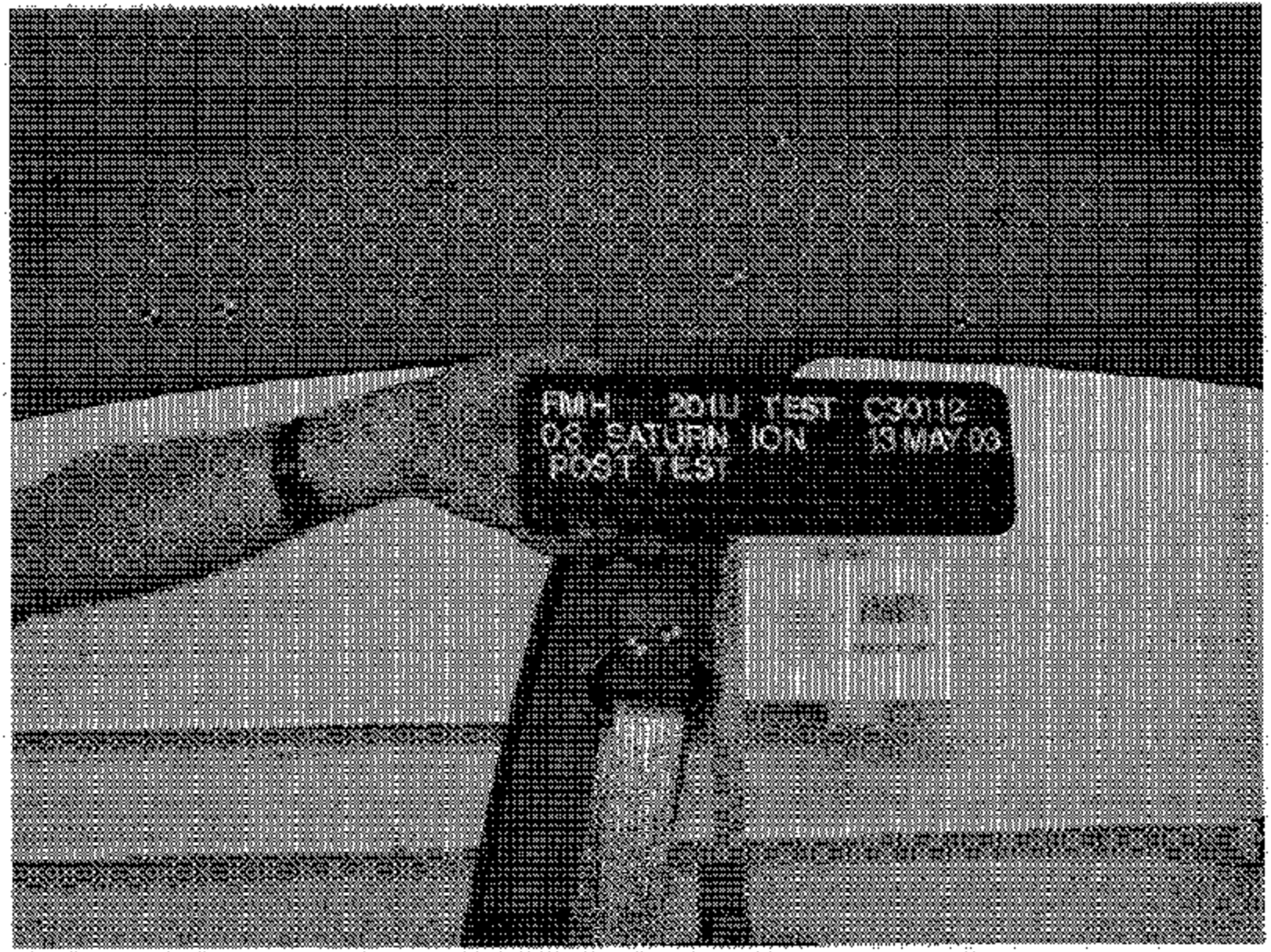


Figure A-25 : POST-TEST PASSENGER SIDE B-PILLAR

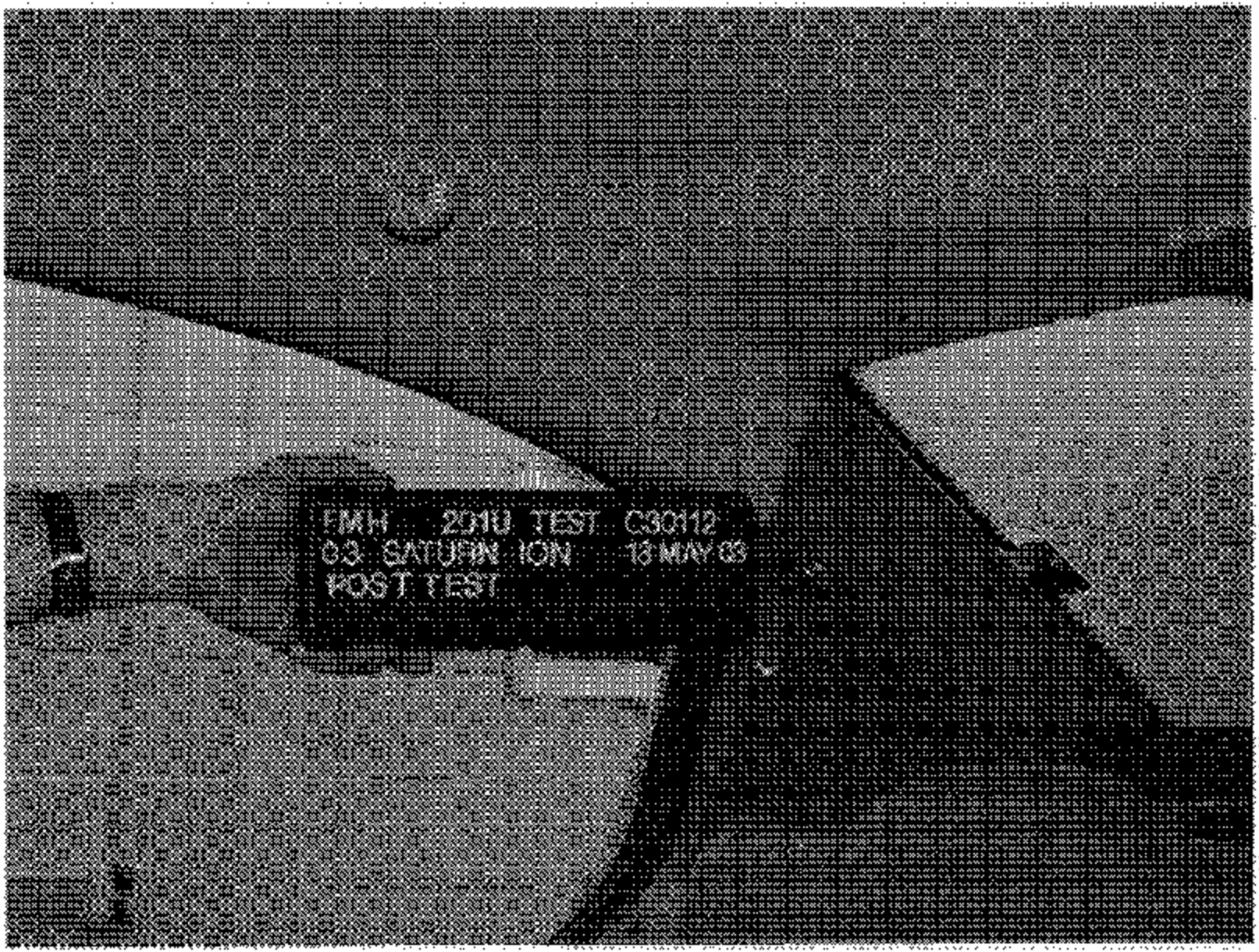


Figure A-26 : POST-TEST PASSENGER SIDE RBAR PILLAR

APPENDIX B

PART 572L PERFORMANCE CALIBRATION IN SUPPORT OF VEHICLE SAFETY COMPLIANCE TESTING FOR OCCUPANT PROTECTION IN INTERIOR IMPACT

Appendix B contains the results from certification tests performed on the Free Motion Headforms utilized in this test program. The results indicate that the headforms meet all of the performance specifications given in 49 CFR Part 572 Subpart L.

The tests were conducted at the Dummy Certification Test Facility of Veridian Engineering. A summary of the test results are included in this Appendix.

PART 572L
HEAD DROP PRE-TEST

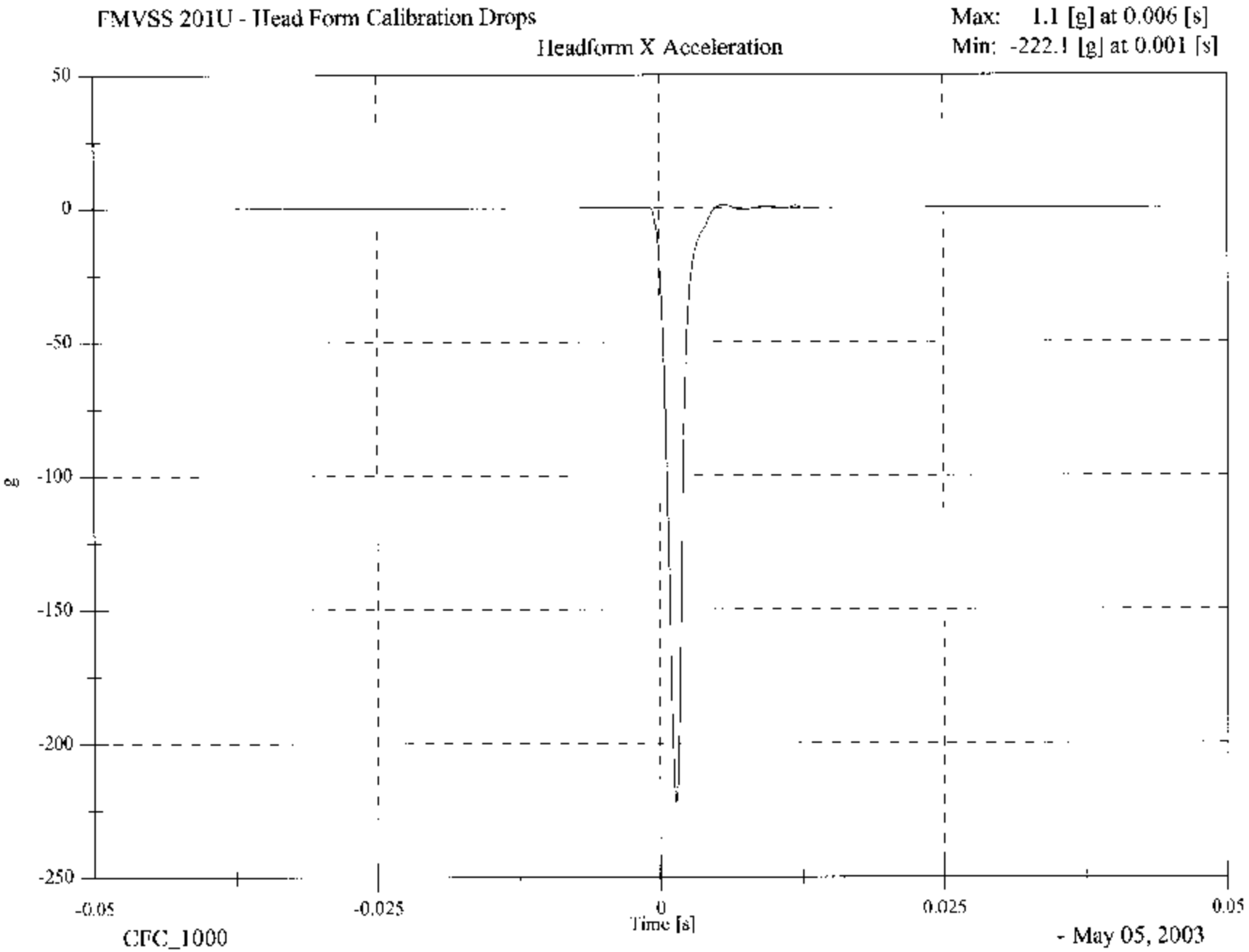
MANUFACTURER:	APPLIED SAFETY TECHNOLOGIES CORPORATION	
SERIAL NUMBER:	0062	
CALIBRATION DATE:	MAY 5, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	19°C to 26°C	21
RELATIVE HUMIDITY	10% to 70%	15
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	251.8
PEAK LATERAL ACCELERATION	15 Gs Maximum	1.1
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

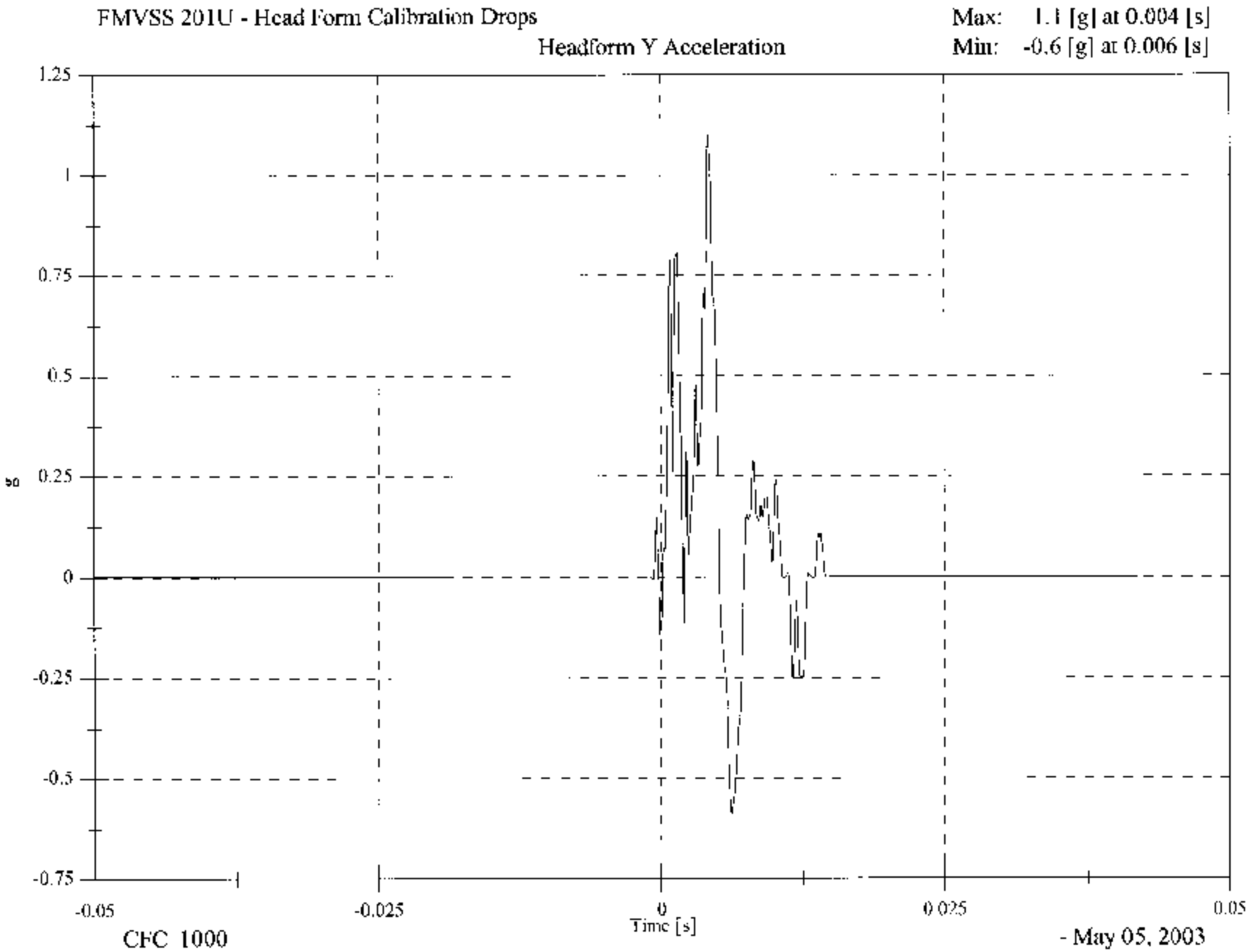
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	J33127	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	J33019	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	J32782	3/03	9/03

REMARKS.

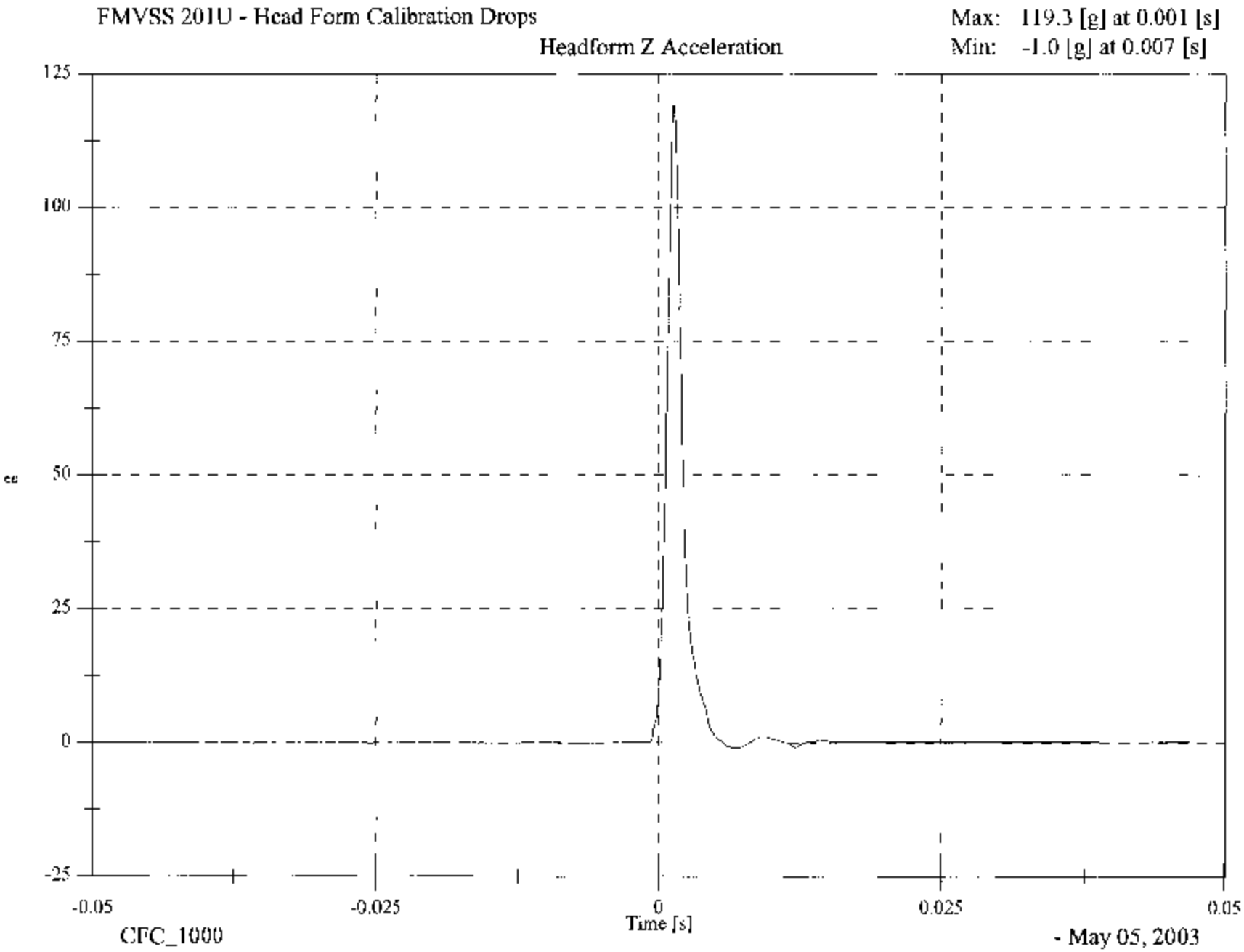
C30112 PRE-TEST 0062 HEAD FORM IMPACT PLOT #1



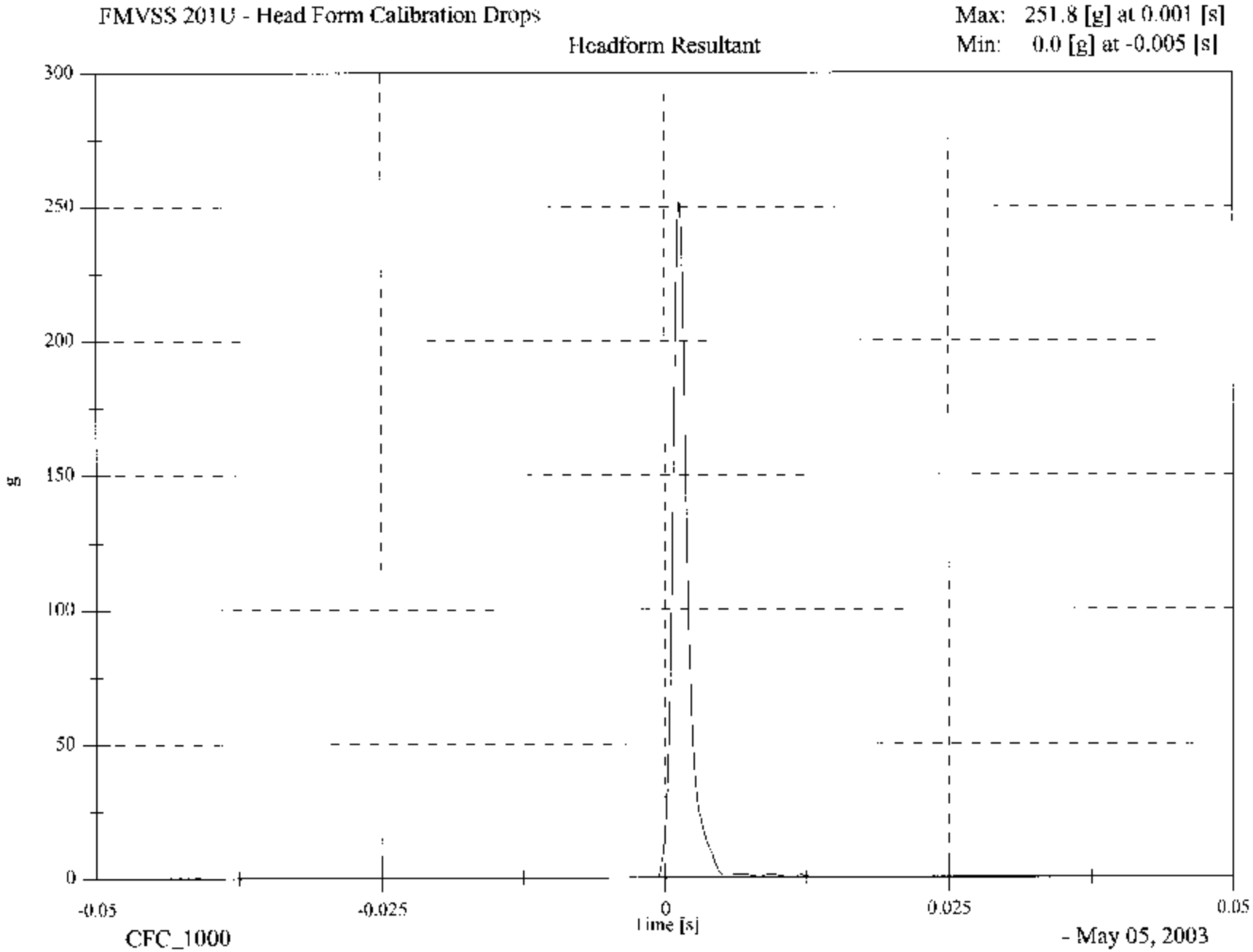
C30112 PRE-TEST 0062 HEAD FORM IMPACT PLOT #2



C3012 PRE-TEST 0062 HEAD FORM IMPACT PLOT #3



C30112 PRE-TEST 0062 HEAD FORM IMPACT PLOT #4



PART 572L
HEAD DROP PRE-TEST

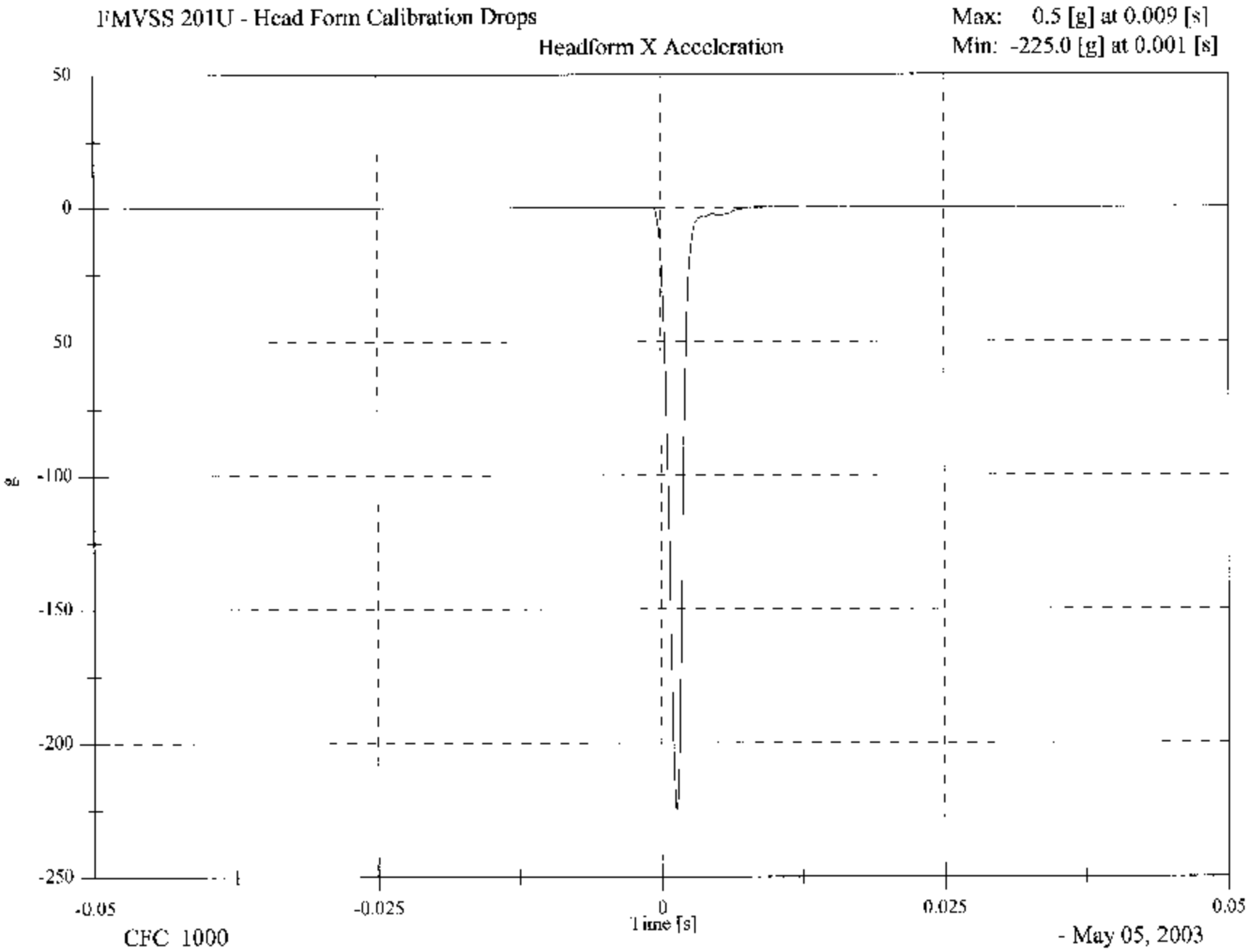
MANUFACTURER:	APPLIED SAFETY TECHNOLOGIES CORPORATION	
SERIAL NUMBER:	0355	
CALIBRATION DATE:	MAY 5, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	19°C to 26°C	21
RELATIVE HUMIDITY	10% to 70%	15
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	254.4
PEAK LATERAL ACCELERATION	15 Gs Maximum	7.5
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

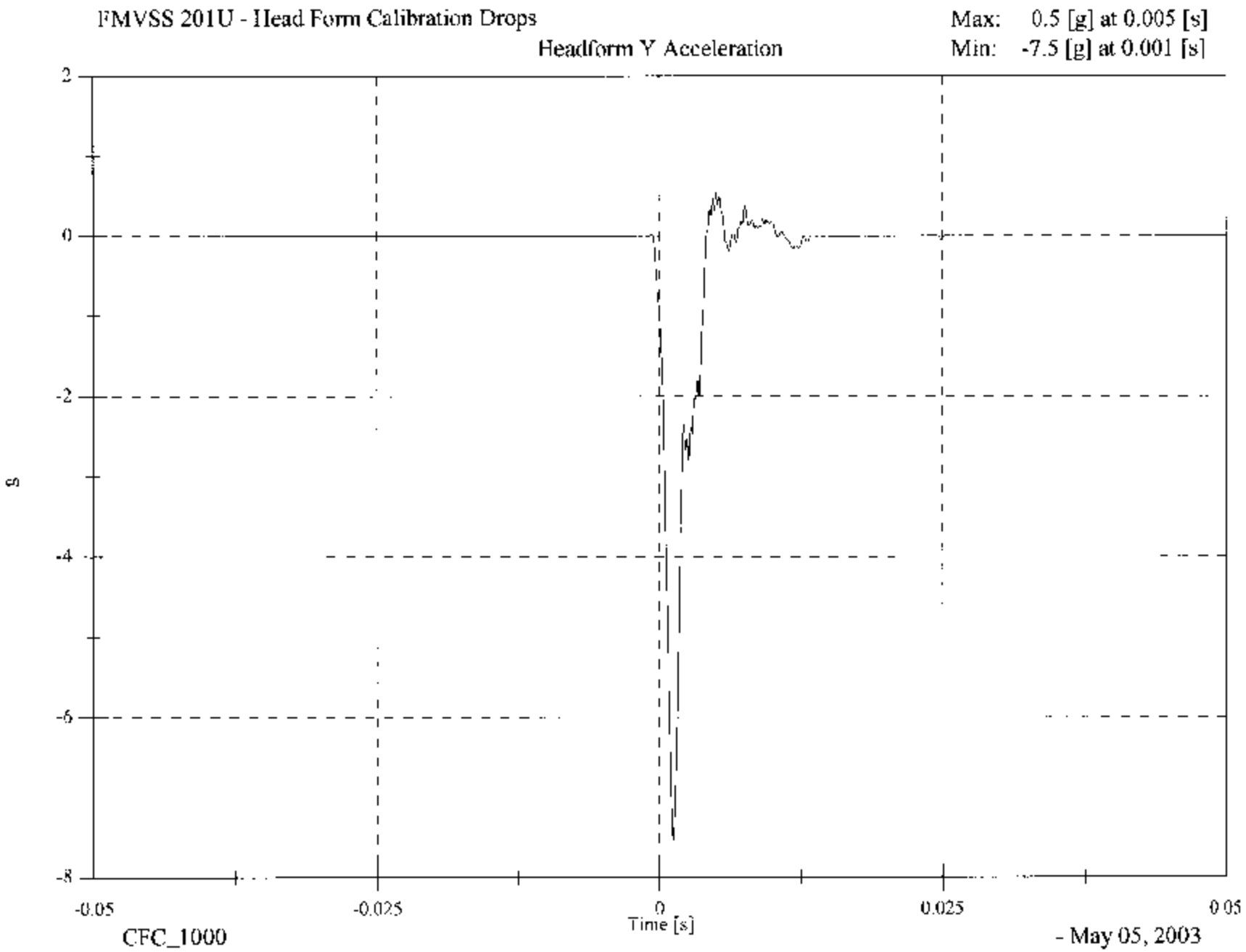
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	J28671	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	J32779	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	J25854	3/03	9/03

REMARKS:

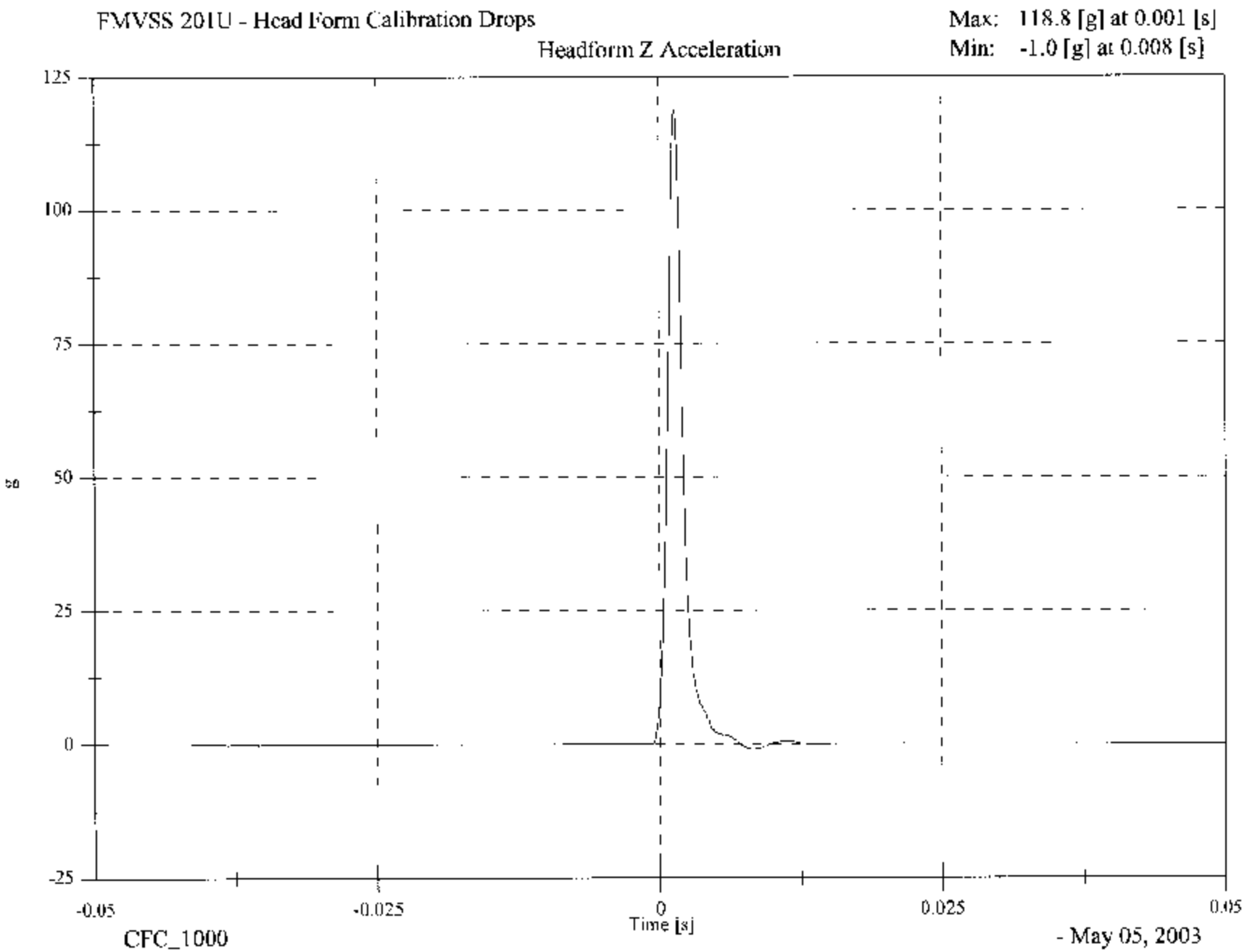
C30112 PRE-TEST 035S HEAD FORM IMPACT PLOT #1



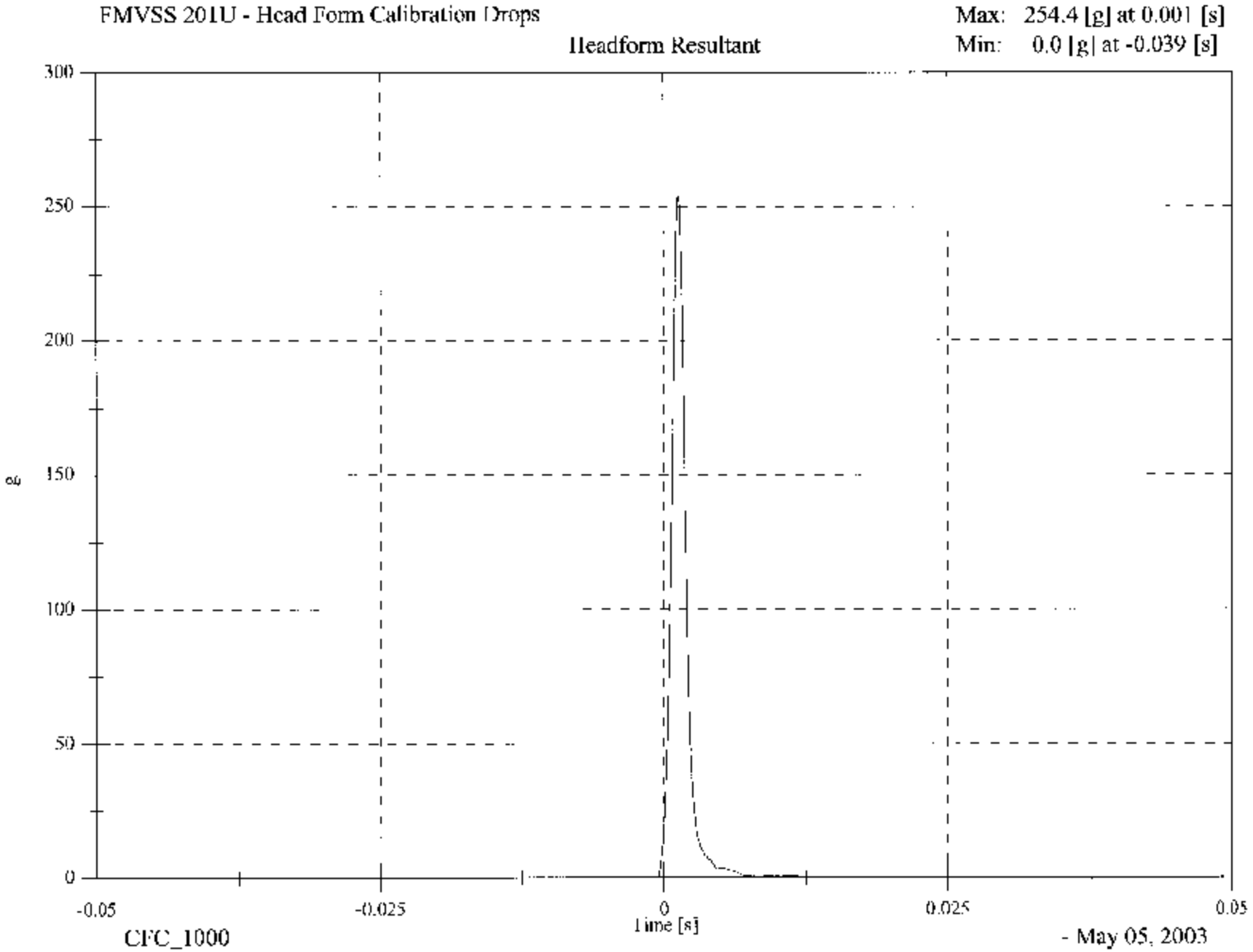
C30112 PRE-TEST 0355 HEAD FORM IMPACT PLOT #2



C30112 PRE-TEST 0355 HEAD FORM IMPACT PLOT #3



C30112 PRE-TEST 0355 HEAD FORM IMPACT PLOT #4



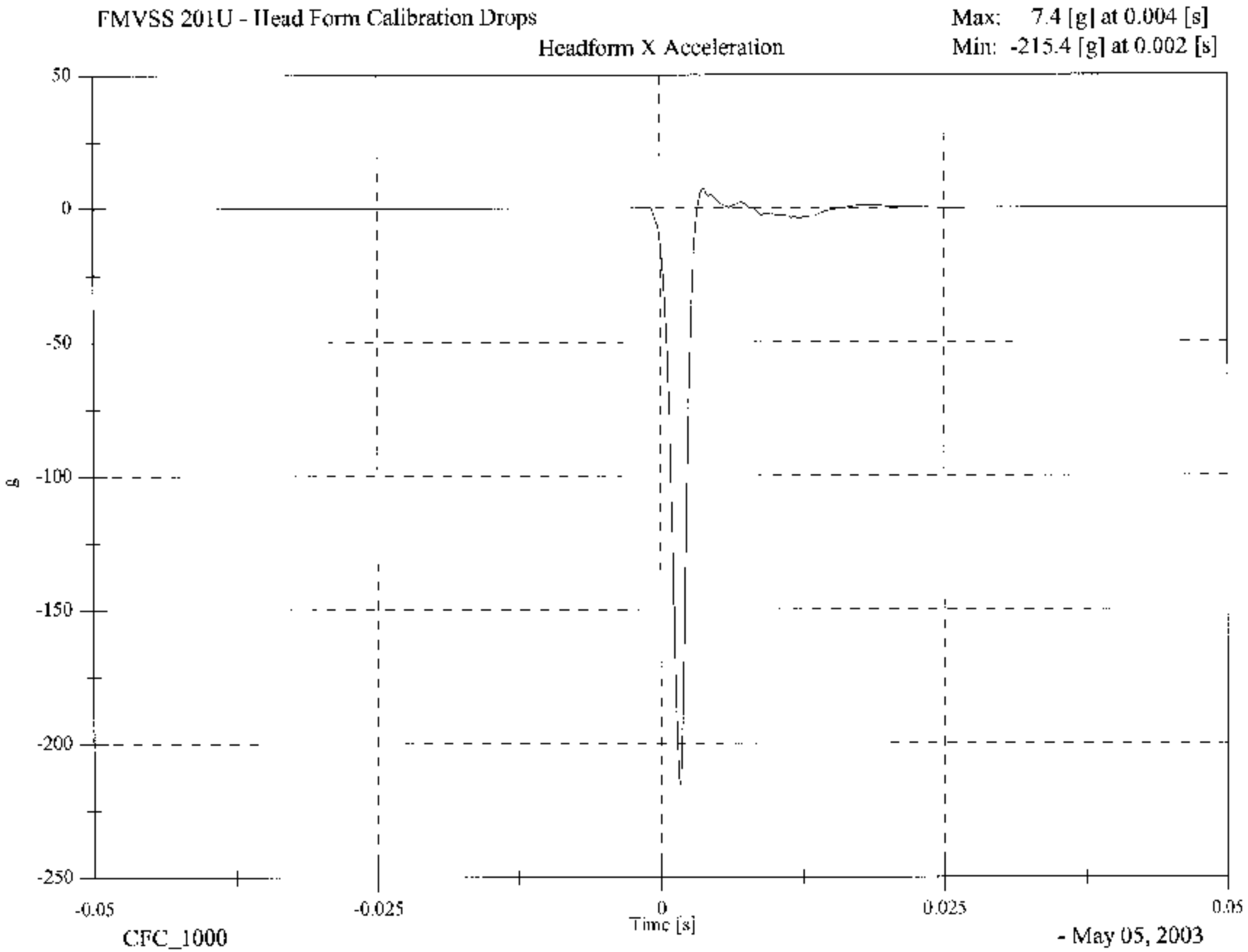
PART 572L
HEAD DROP PRE-TEST

MANUFACTURER:	FIRST TECHNOLOGIES SAFETY SYSTEMS	
SERIAL NUMBER	0642	
CALIBRATION DATE	MAY 5, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	19°C to 26°C	2.
RELATIVE HUMIDITY	10% to 70%	15
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	243.4
PEAK LATERAL ACCELERATION	15 Gs Maximum	7.8
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

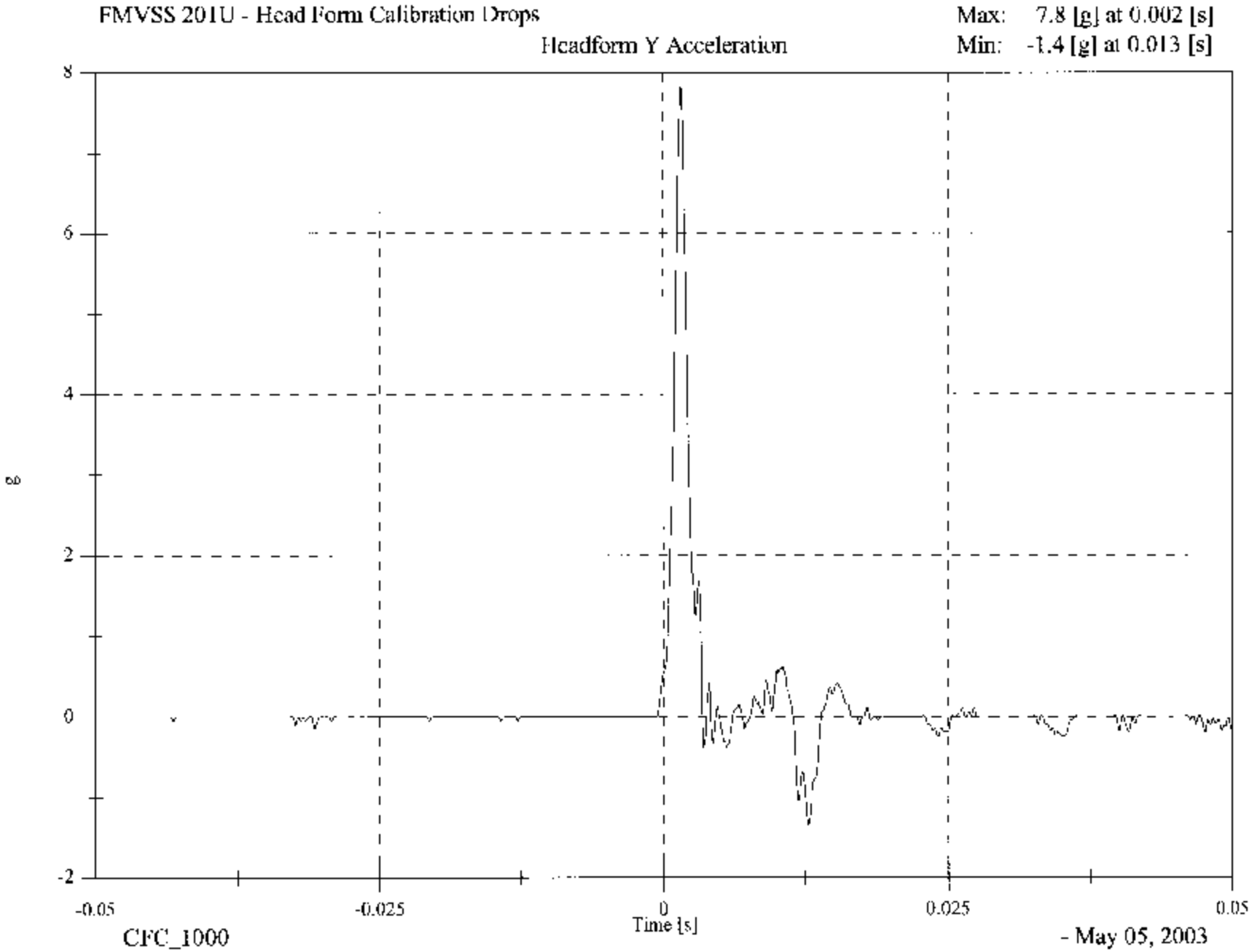
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	J24876	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	J33030	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	J31009	3/03	9/03

REMARKS:

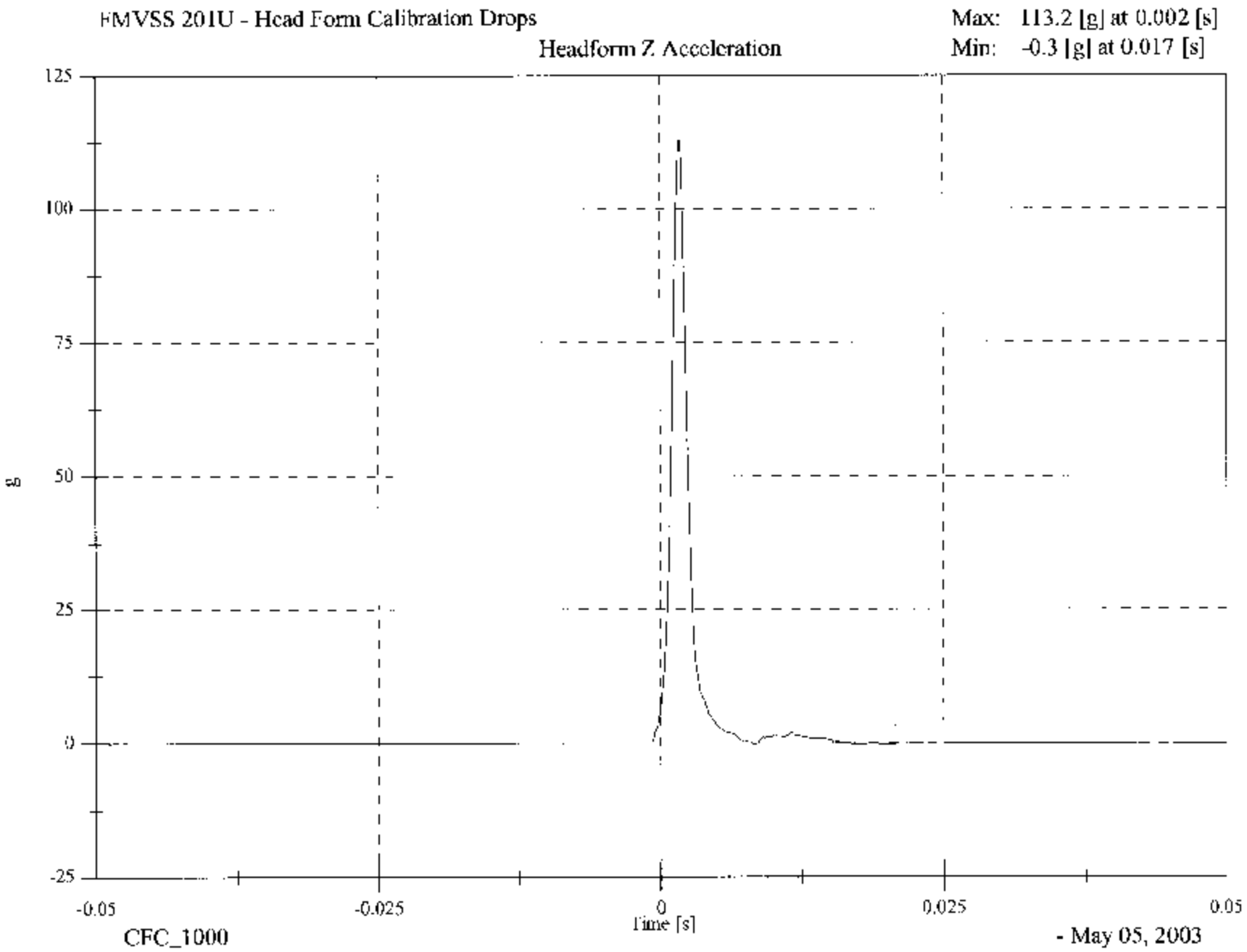


C30112 PRE-TEST 0642 HEAD FORM IMPACT PLOT #1

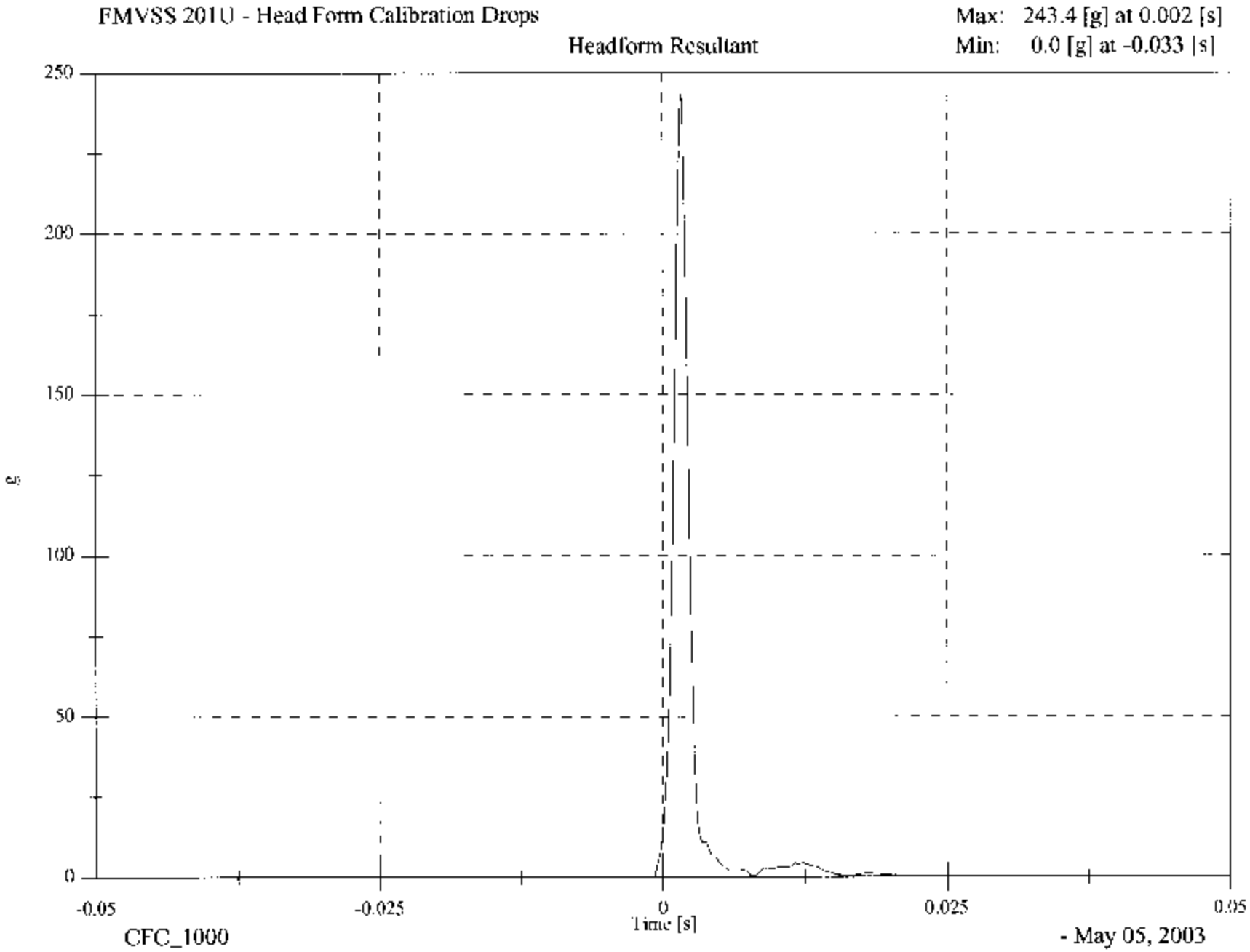
C30112 PRE-TEST 0642 HEAD FORM IMPACT PLOT #2



C30112 PRE-TEST 0642 HEAD FORM IMPACT PLOT #3



C30112 PRE-TEST 0642 HEAD FORM IMPACT PLOT #4



PART 572L
HEAD DROP PRE-TEST

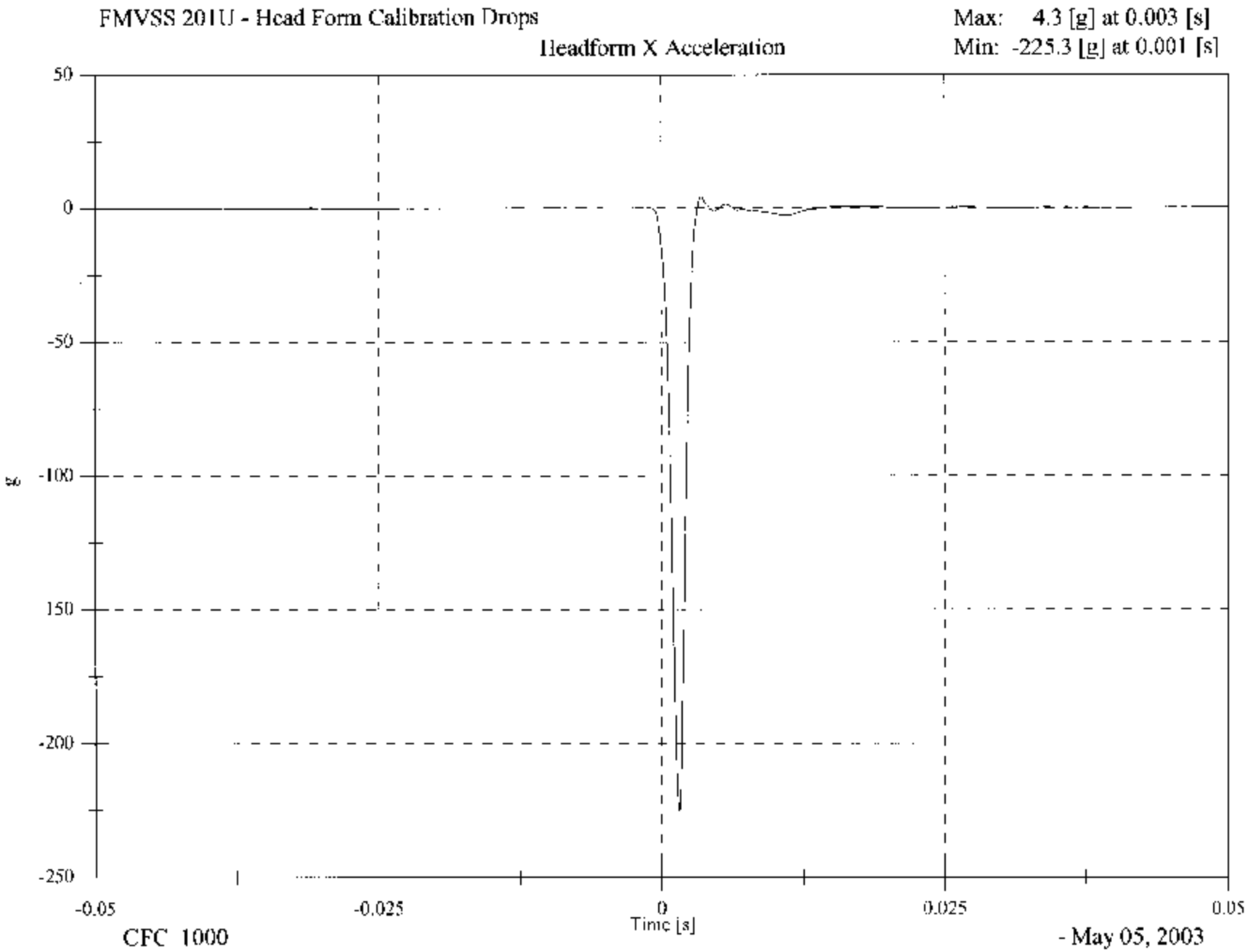
MANUFACTURER:	FIRST TECHNOLOGIES SAFETY SYSTEMS	
SERIAL NUMBER:	0805	
CALIBRATION DATE:	MAY 5, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	19°C to 26°C	21
RELATIVE HUMIDITY	10% to 70%	35
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	251.5
PEAK LATERAL ACCELERATION	15 Gs Maximum	1.9
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

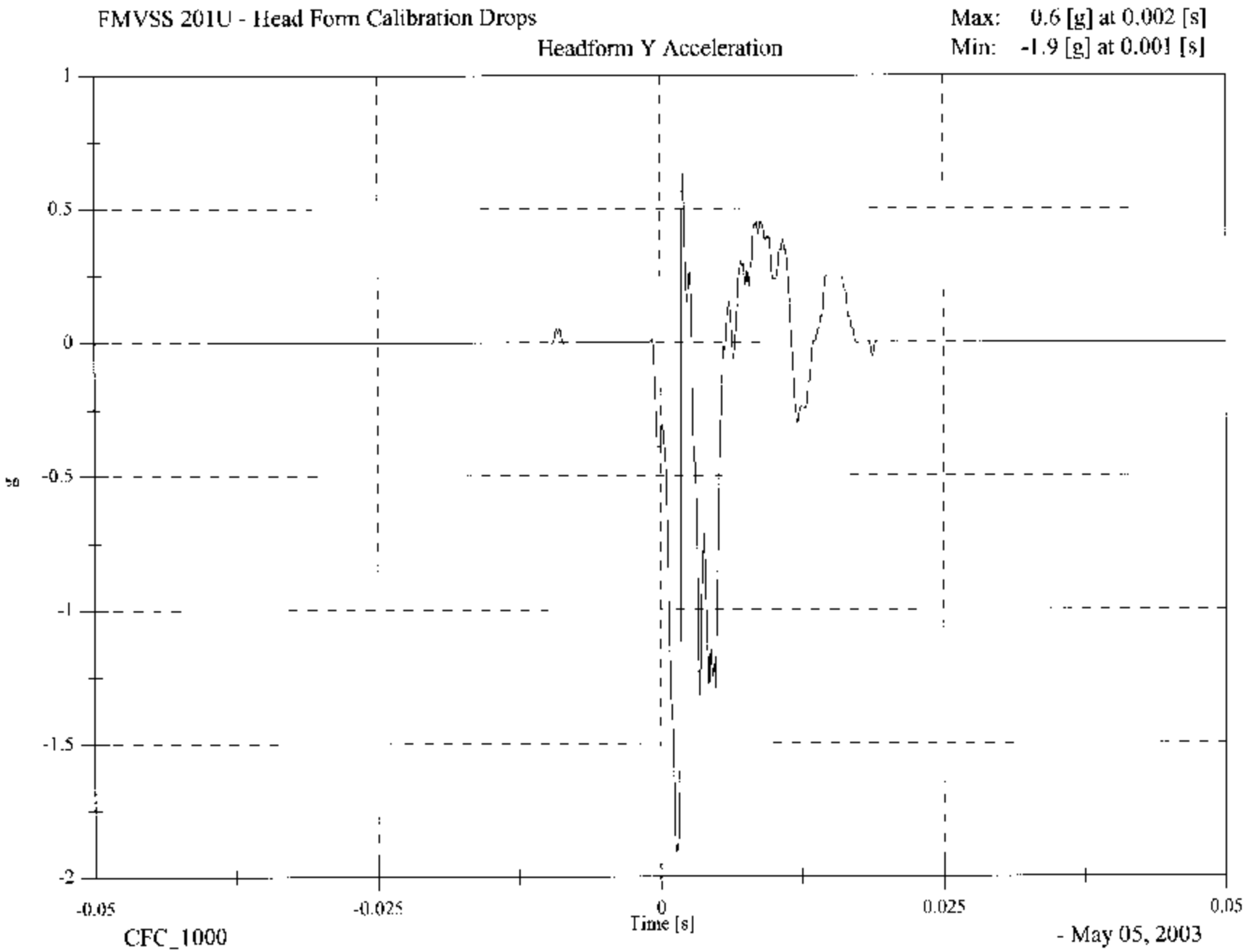
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	JJ6127	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	JJ7980	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	JJ7854	3/03	9/03

REMARKS

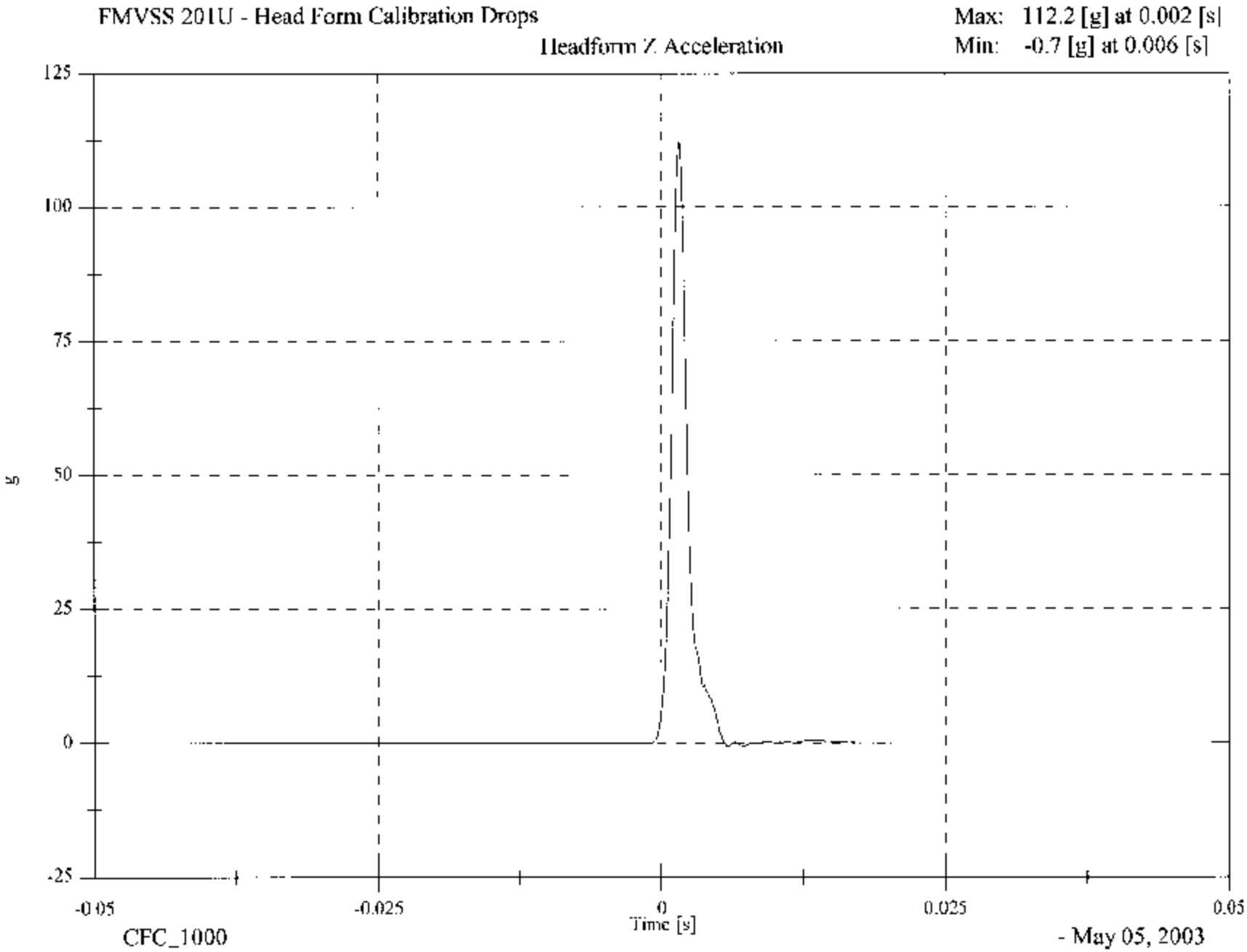
C30112 PRE-TEST 0805 HEAD FORM IMPACT PLOT #1



C30112 PRE-TEST 0805 HEAD FORM IMPACT PLOT #2



C30112 PRE-TEST 0805 HEAD FORM IMPACT PLOT #3



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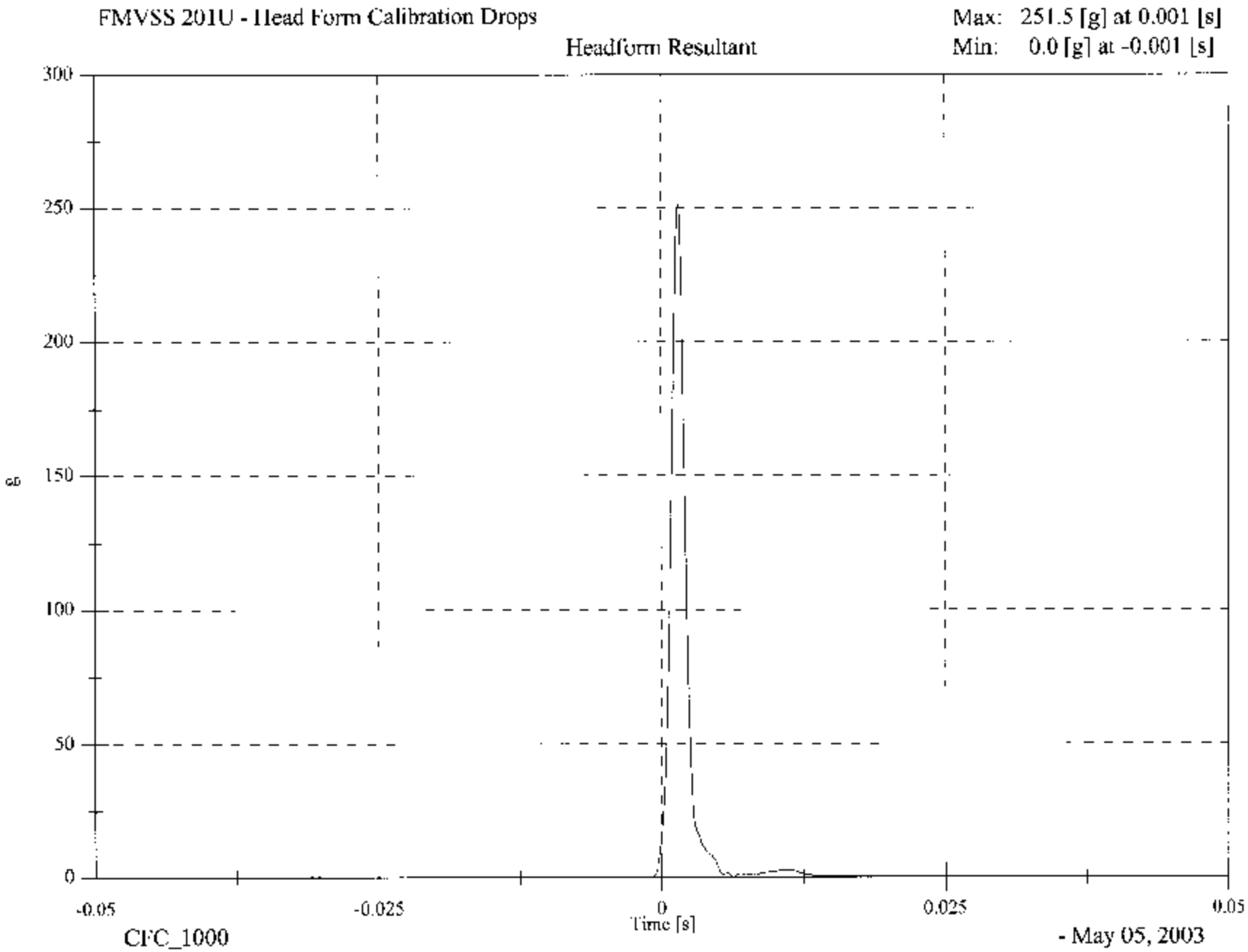


PART 572L
HEAD DROP PRE-TEST

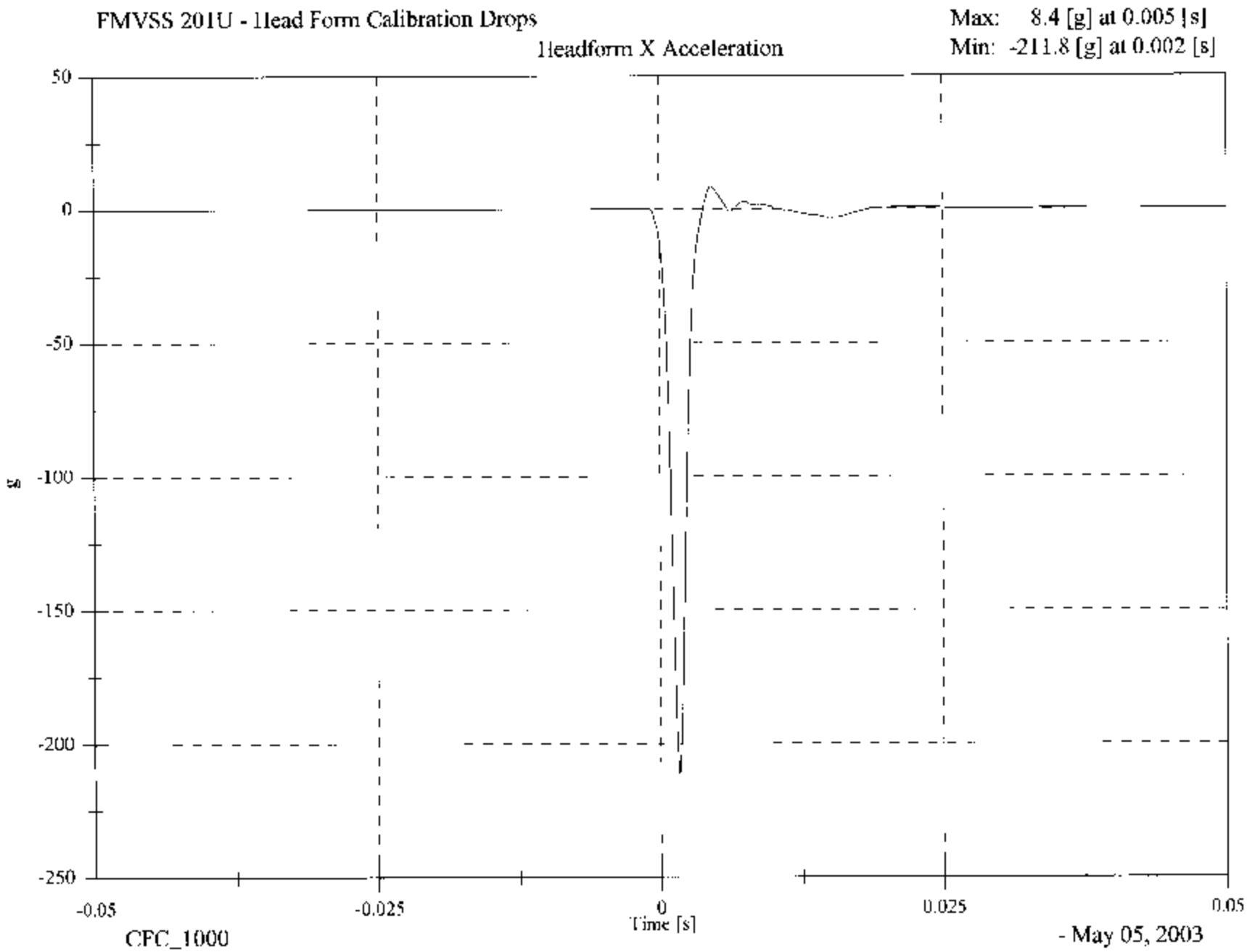
MANUFACTURER:	APPLIED SAFETY TECHNOLOGIES CORPORATION	
SERIAL NUMBER	1255	
CALIBRATION DATE	MAY 5, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	15°C to 28°C	21
RELATIVE HUMIDITY	10% to 70%	15
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	234.7
PEAK LATERAL ACCELERATION	15 Gs Maximum	3.8
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

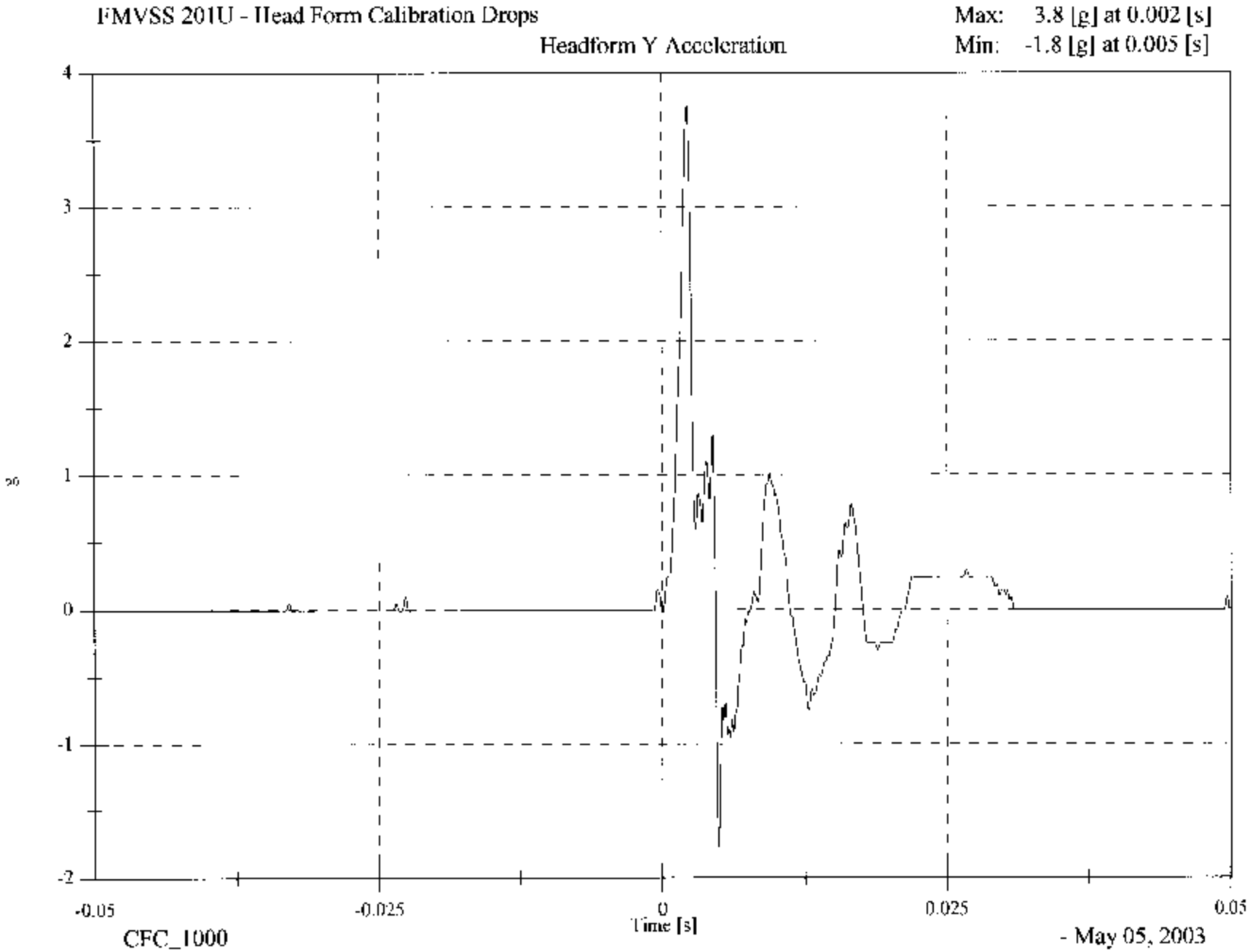
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	J41006	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	J40994	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	J41007	3/03	9/03

REMARKS:

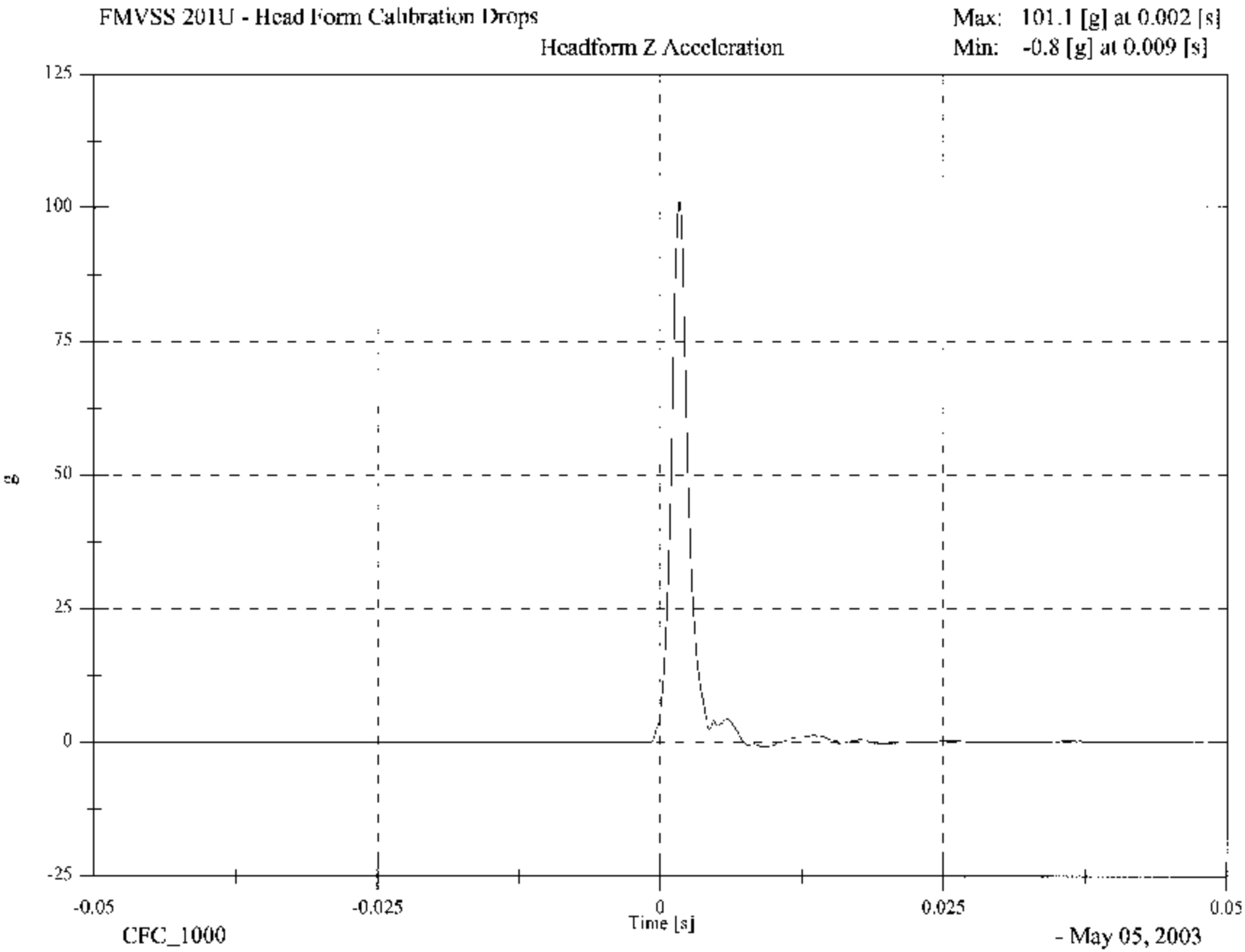
C30112 PRE-TEST 12SS HEAD FORM IMPACT PLOT #1



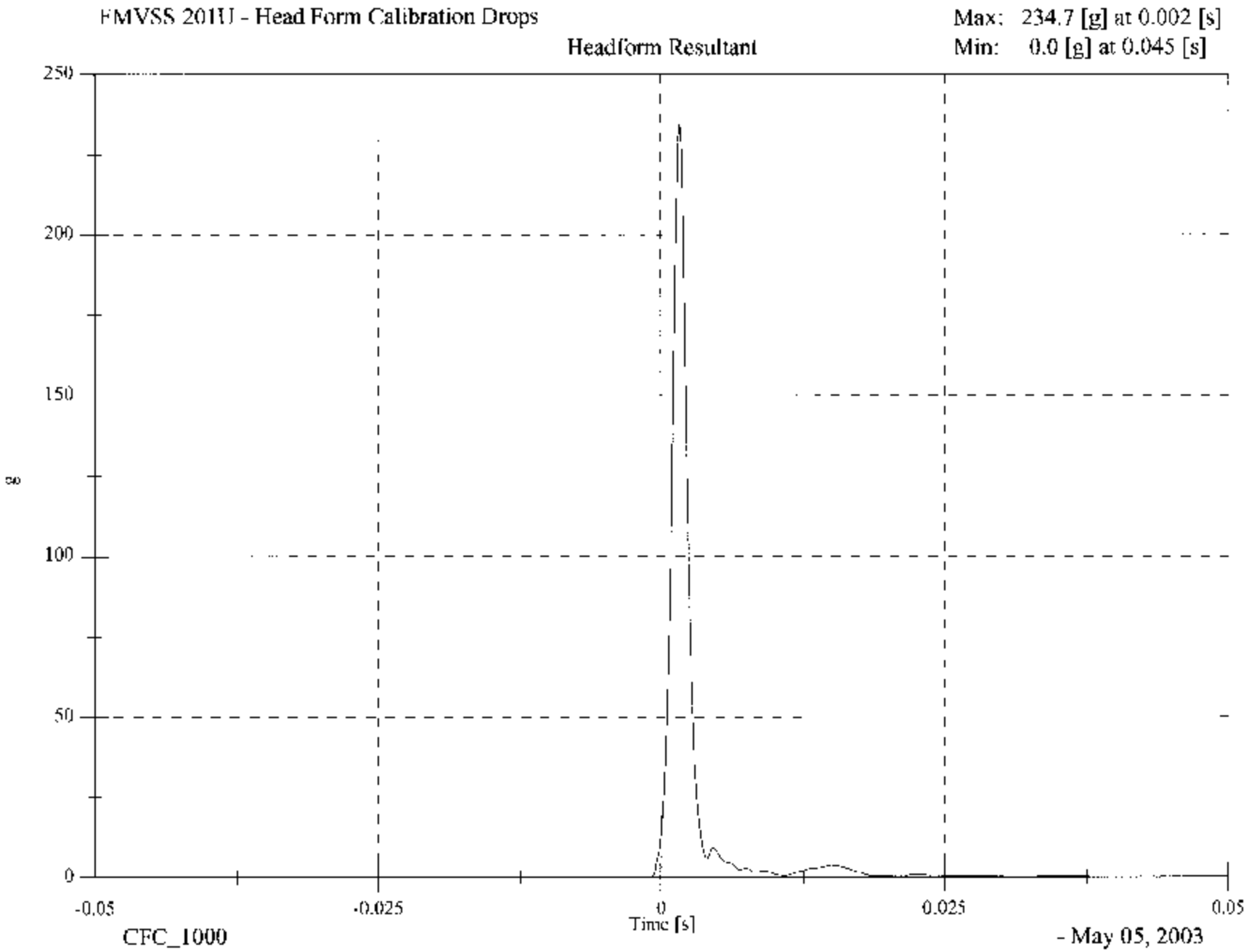
C30112 PRE-TEST 1255 HEAD FORM IMPACT PLOT #2



C30112 PRE-TEST 1255 HEAD FORM IMPACT PLOT #3



C30112 PRE-TEST 1255 HEAD FORM IMPACT PLOT #4



PART 572L
HEAD DROP POST-TEST

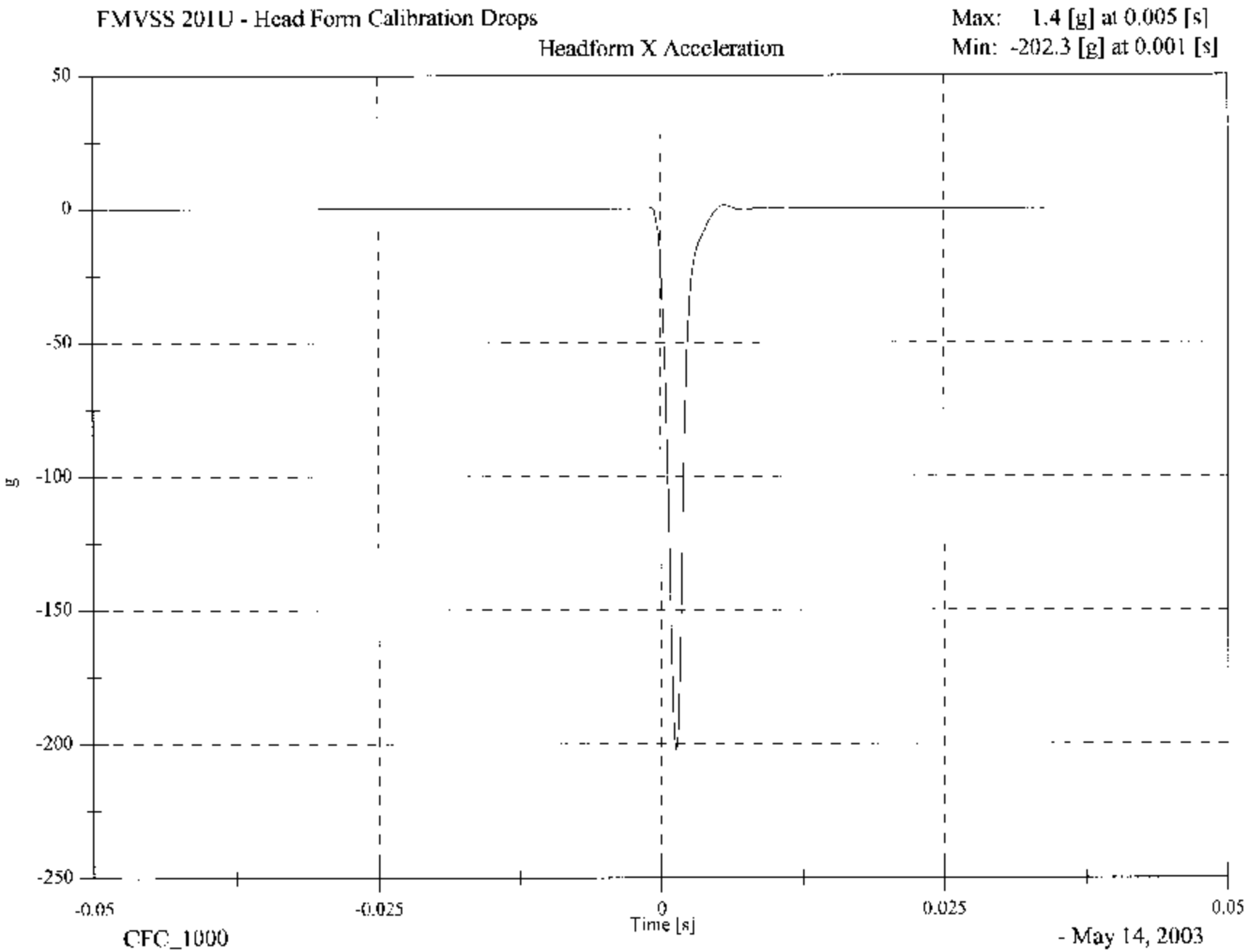
MANUFACTURER:	APPLIED SAFETY TECHNOLOGIES CORPORATION	
SERIAL NUMBER:	9002	
CALIBRATION DATE:	MAY 14, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	19°C to 26°C	22
RELATIVE HUMIDITY	10% to 70%	33
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	228.8
PEAK LATERAL ACCELERATION	15 Gs Maximum	1.1
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

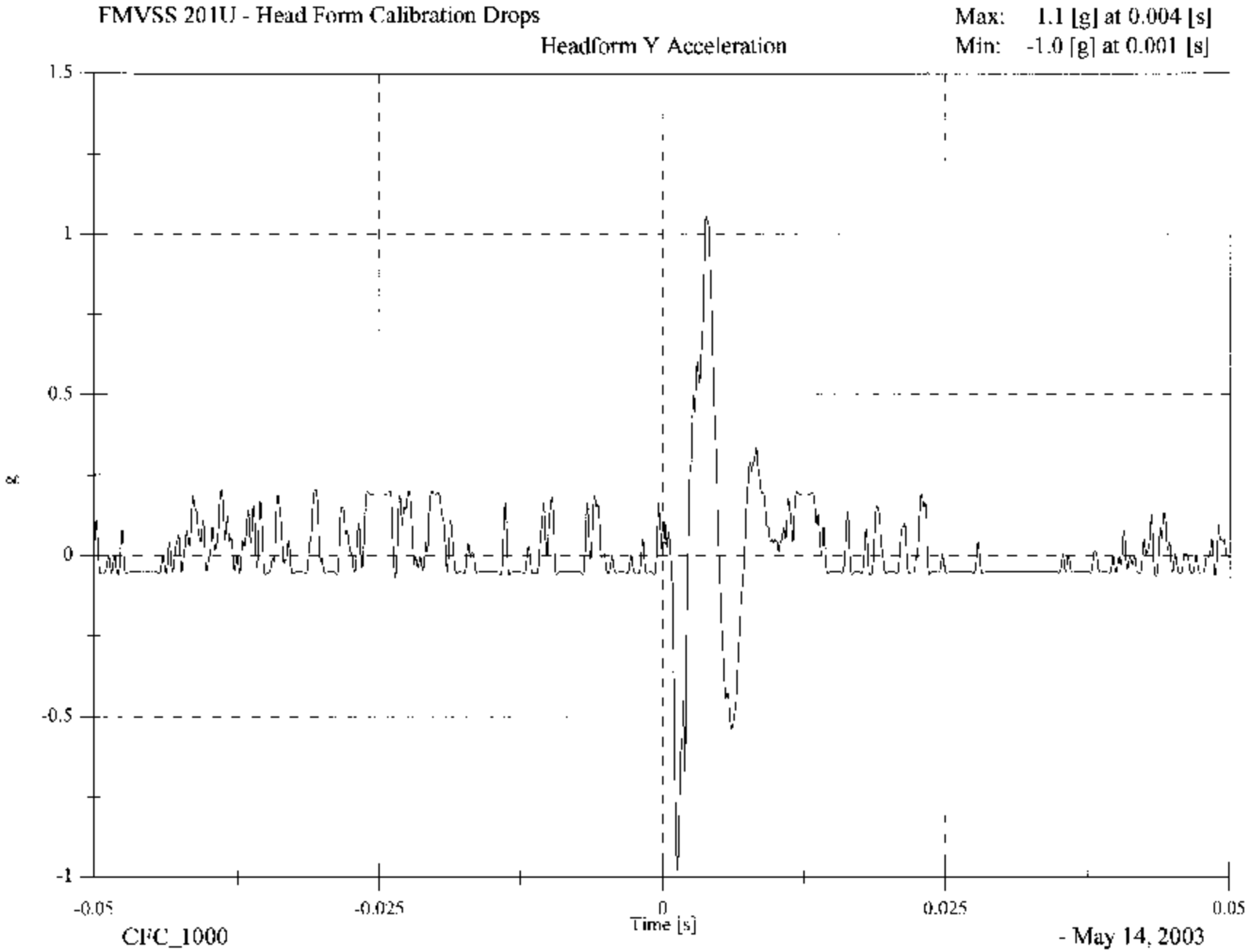
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	J33127	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	J33019	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	J32782	3/03	9/03

REMARKS:

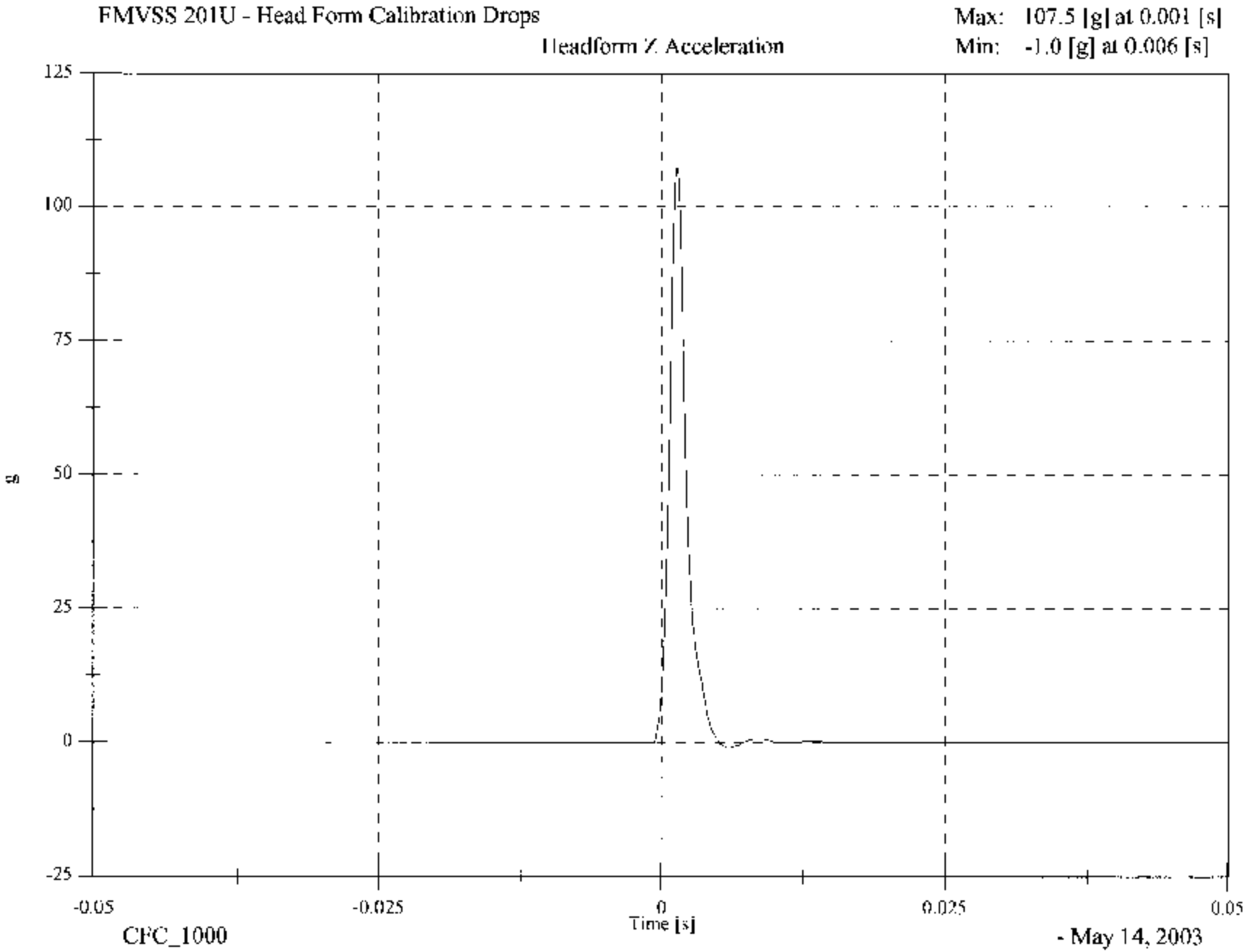
C30112 POST-TEST 0062 HEAD FORM IMPACT PLOT #1



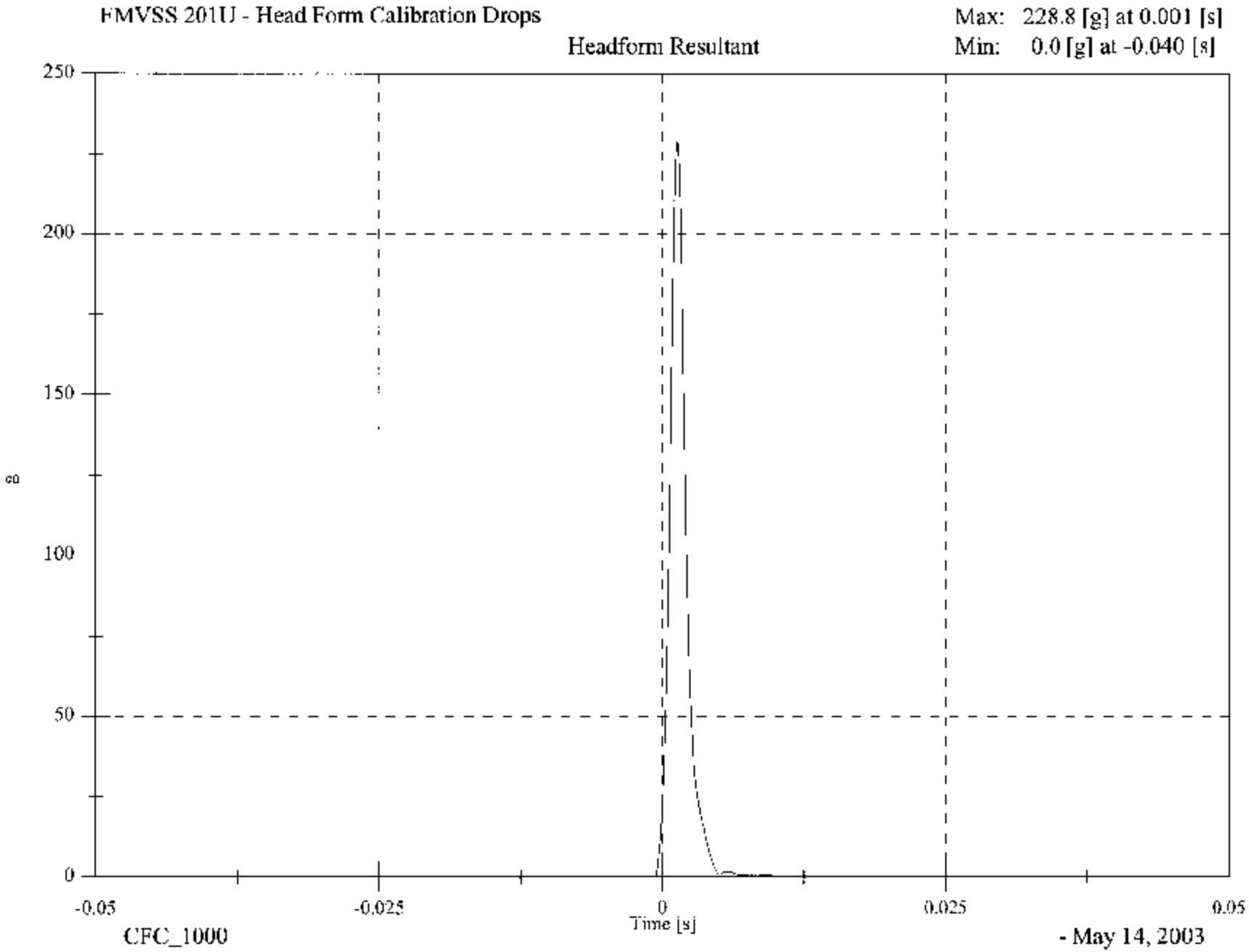
C30112 POST-TEST 0062 HEAD FORM IMPACT PLOT #2



C30112 POST-TEST 0062 HEAD FORM IMPACT PLOT #3



C30112 POST-TEST 0062 HEAD FORM IMPACT PLOT #4



PART 572I
HEAD DROP POST-TEST

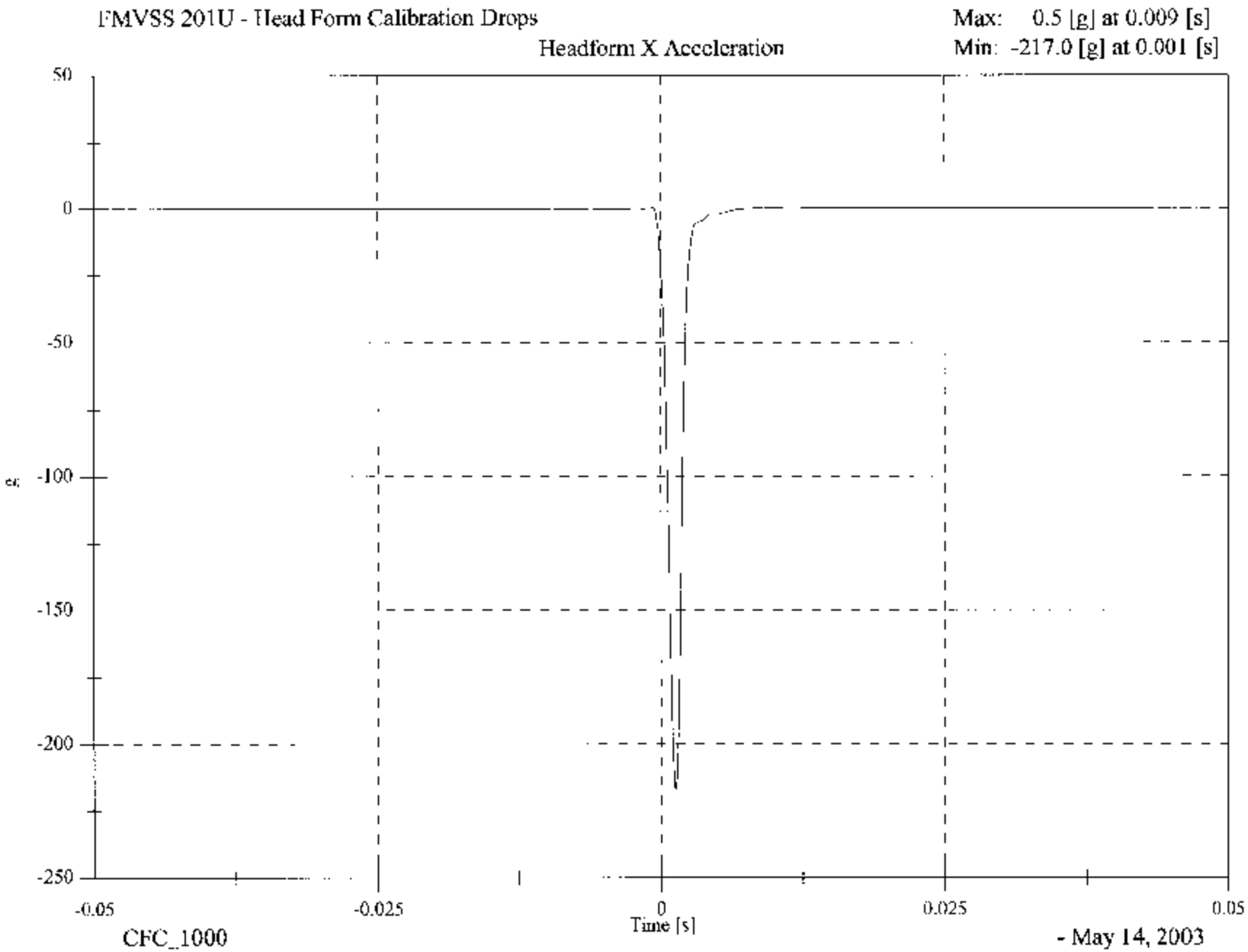
MANUFACTURER:	APPLIED SAFETY TECHNOLOGIES CORPORATION	
SERIAL NUMBER:	0355	
CALIBRATION DATE:	MAY 14, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	19°C to 26°C	22
RELATIVE HUMIDITY	10% to 70%	33
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	248.5
PEAK LATERAL ACCELERATION	15 Gs Maximum	3.5
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

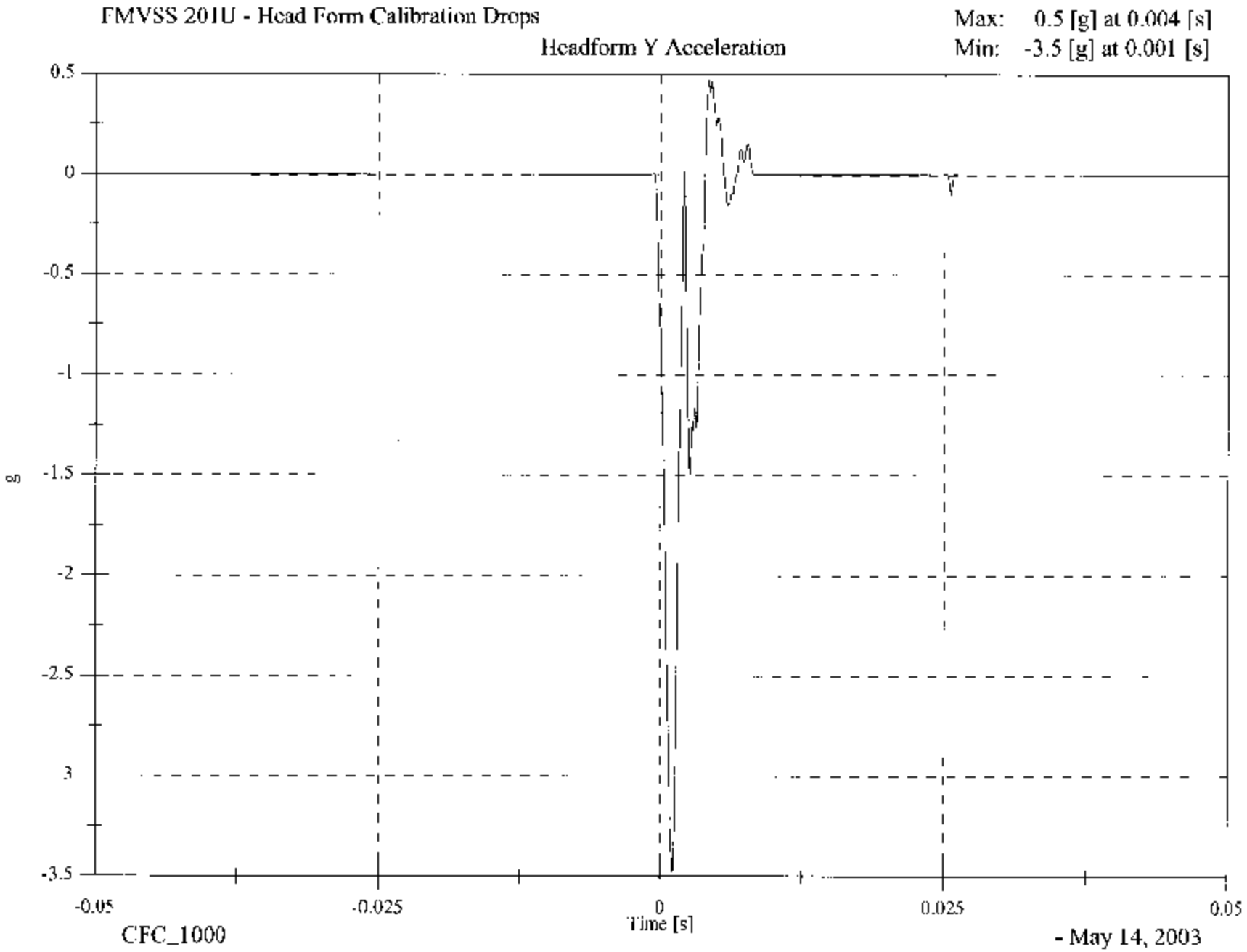
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	J28671	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	J32779	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	J25854	3/03	9/03

REMARKS:

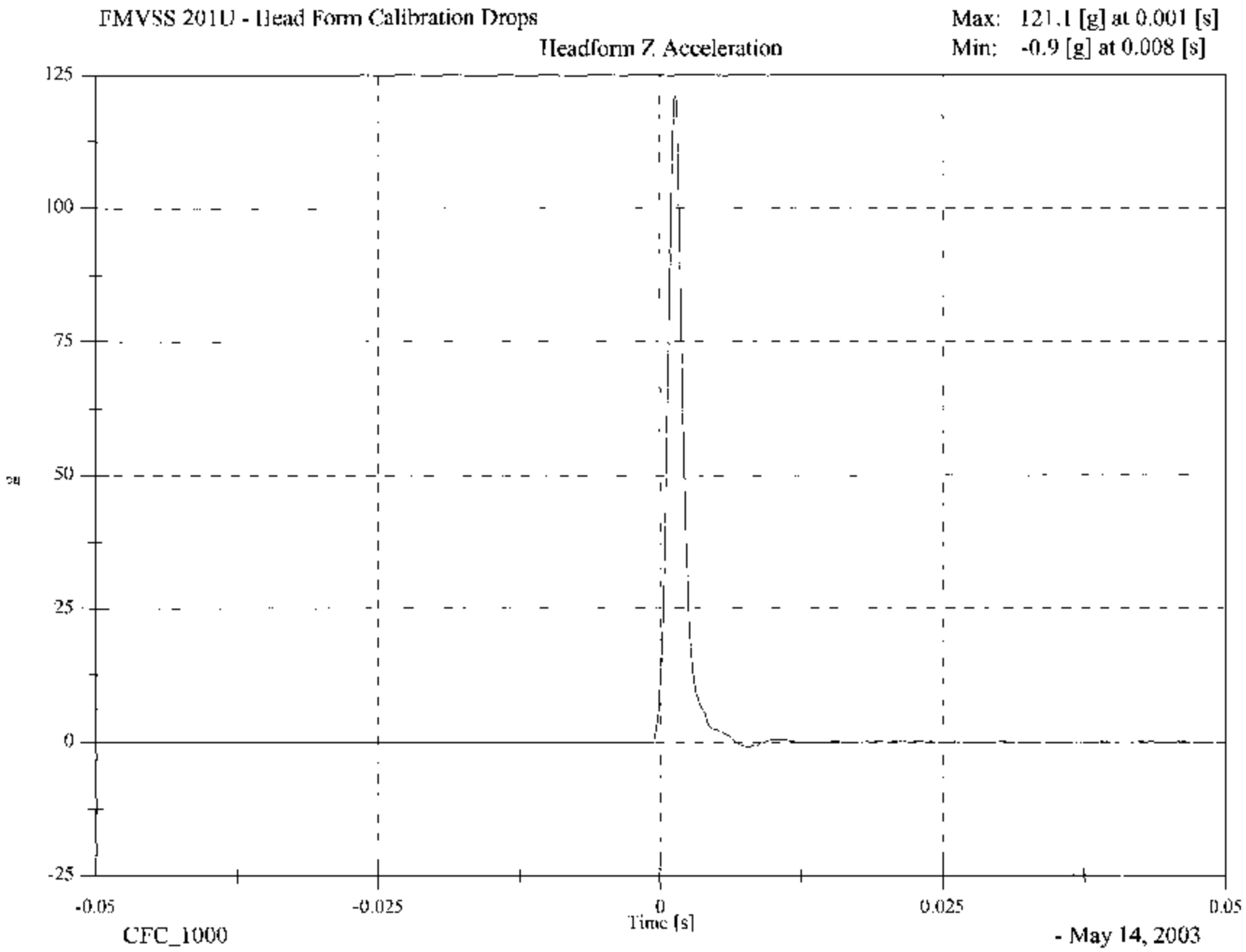
C30112 POST-TEST 0355 HEAD FORM IMPACT PLOT #1



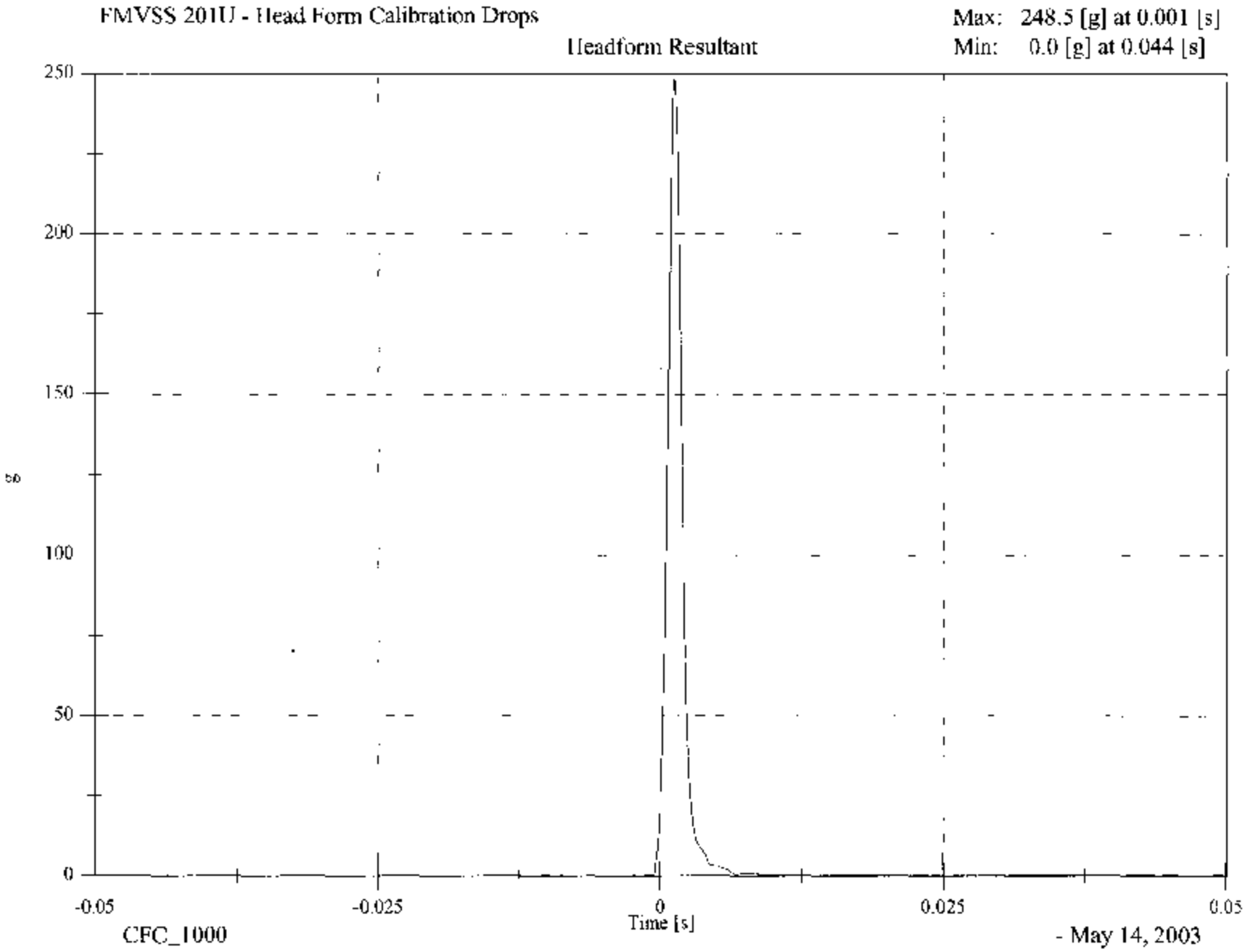
C30112 POST-TEST 0355 HEAD FORM IMPACT PLOT #2



C30112 POST-TEST 0355 HEAD FORM IMPACT PLOT #3



C30112 POST-TEST 0355 HEAD FORM IMPACT PLOT #4



PART 572E
HEAD DROP POST-TEST

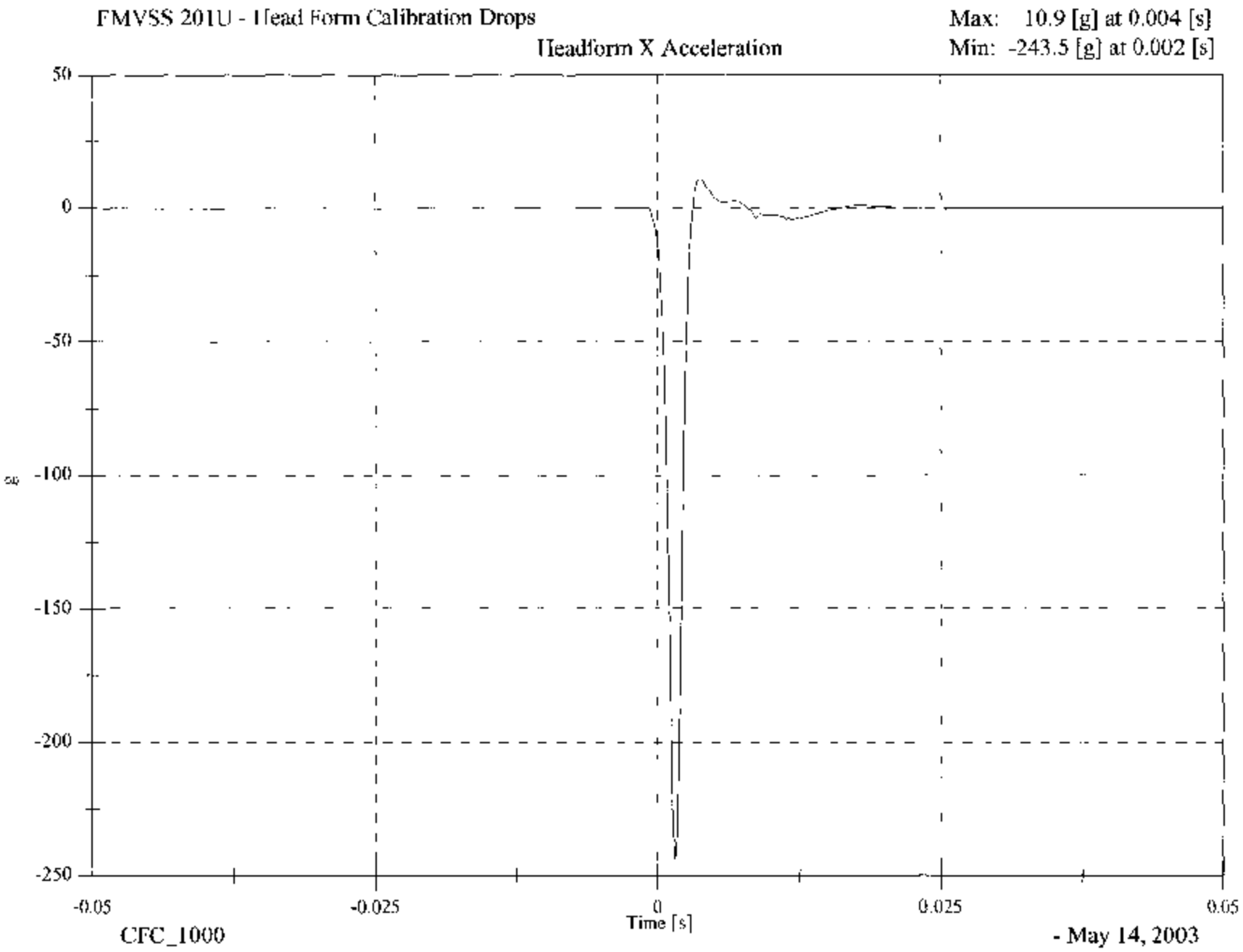
MANUFACTURER:	FIRST TECHNOLOGIES SAFETY SYSTEMS	
SERIAL NUMBER:	0642	
CALIBRATION DATE:	MAY 14, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	19°C to 26°C	22
RELATIVE HUMIDITY	10% to 70%	33
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	272.5
PEAK LATERAL ACCELERATION	15 Gs Maximum	4.6
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

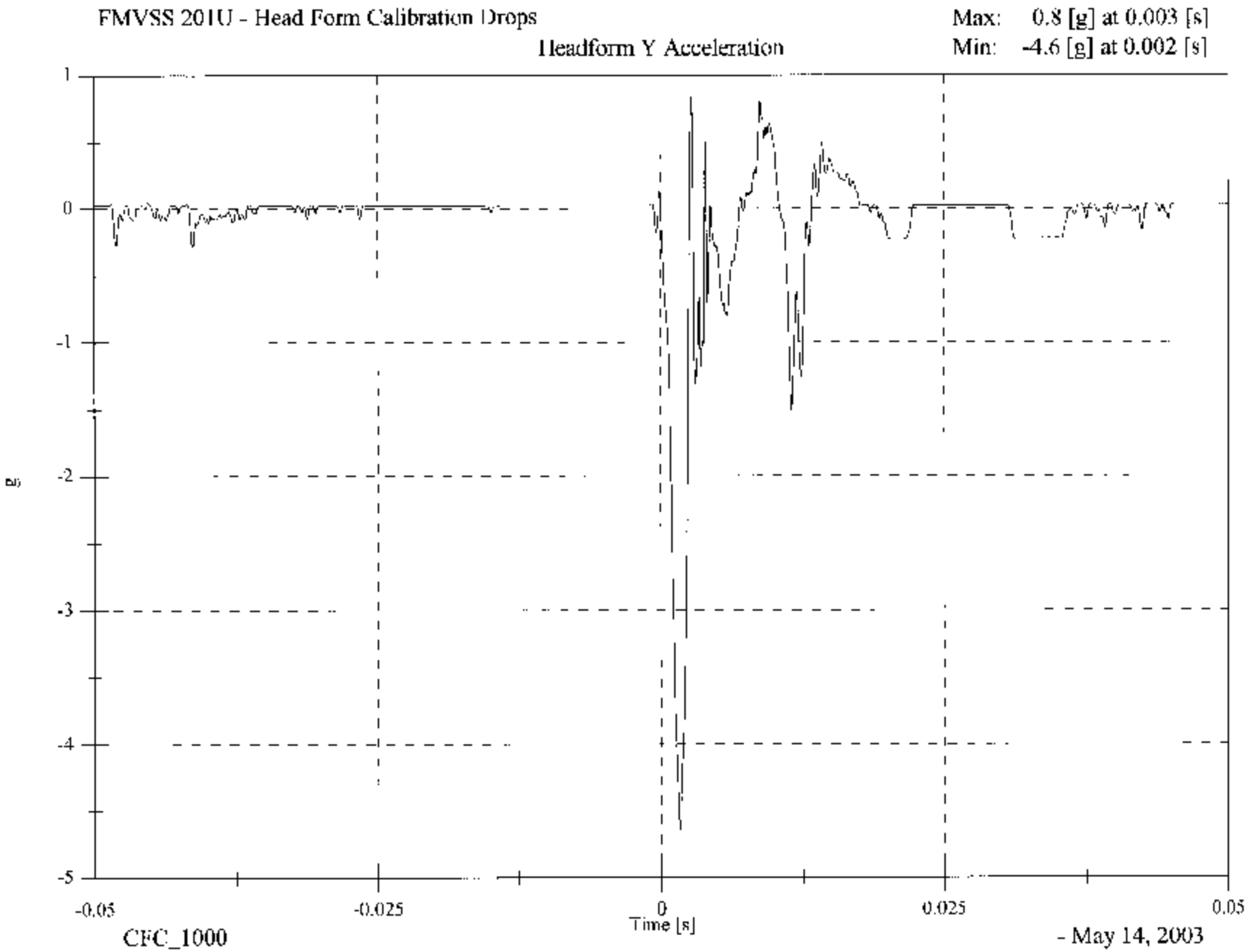
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	J24875	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	J33030	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	J31009	3/03	9/03

REMARKS:

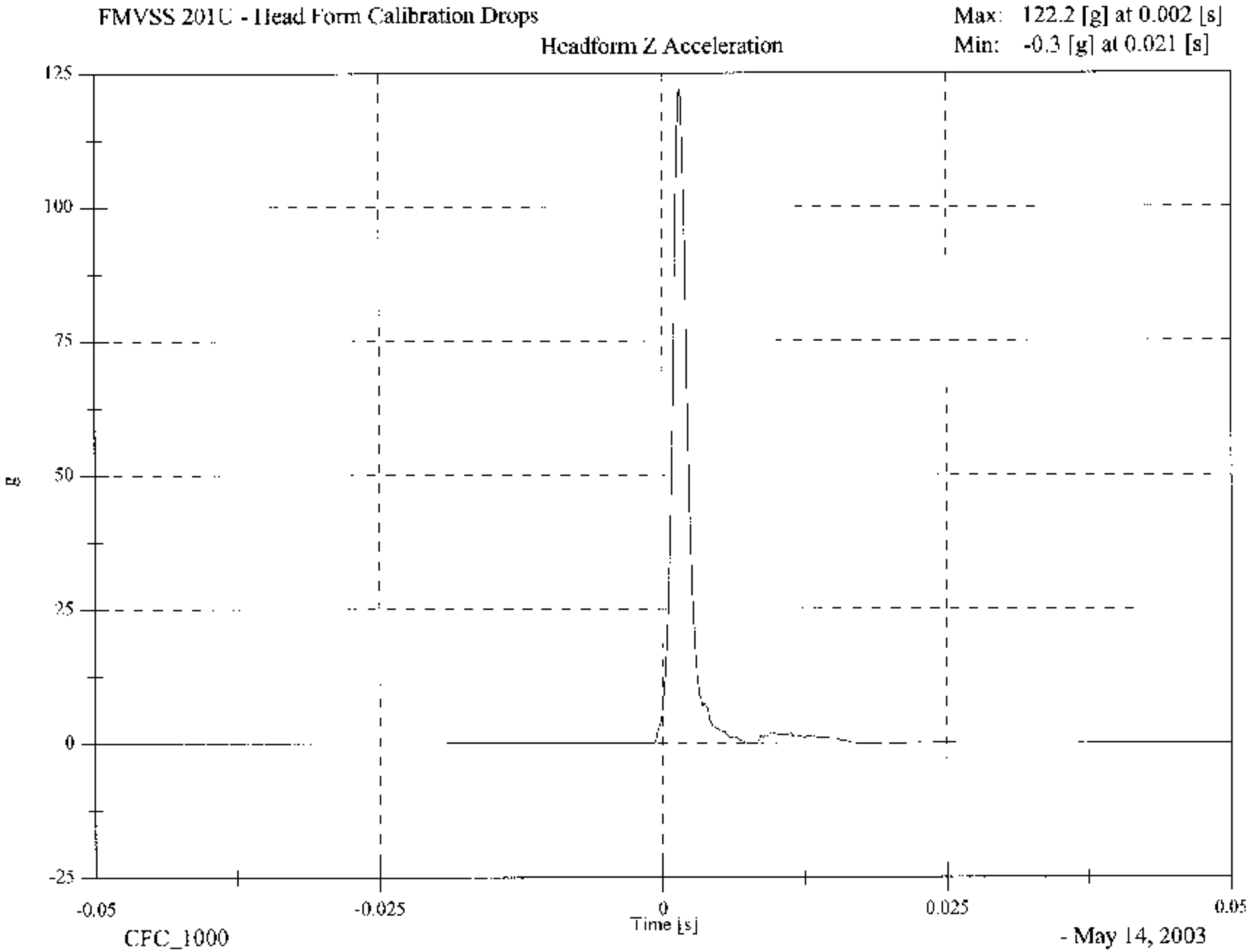
C30112 POST-TEST 0642 HEAD FORM IMPACT PLOT #1

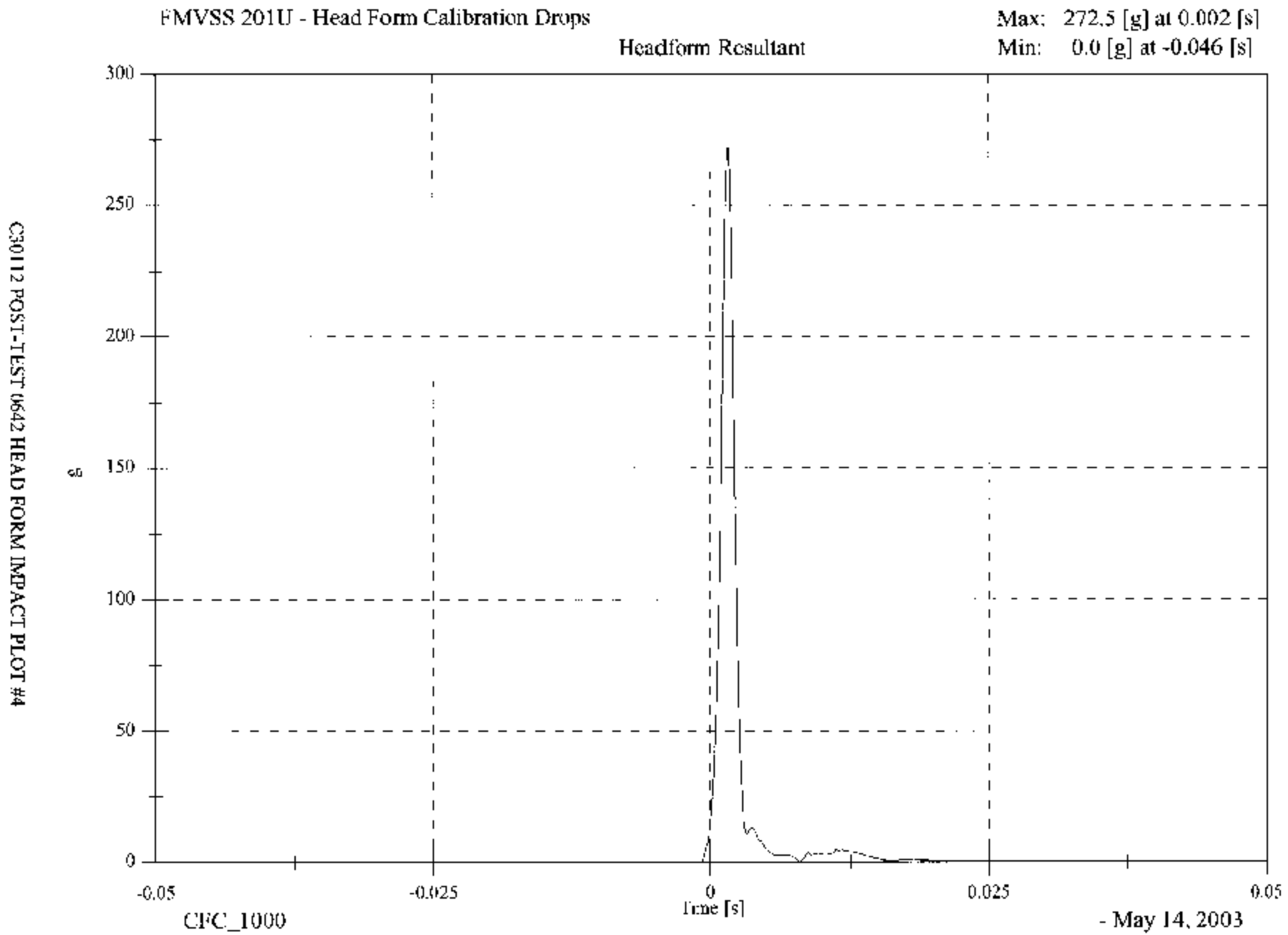


C30112 POST-TEST 0642 HEAD FORM IMPACT PLOT #2



C30112 POST-TEST 0642 HEAD FORM IMPACT PLOT #3





C30112 POST-TEST 0642 HEAD FORM IMPACT PLOT #4

PART 572L
HEAD DROP POST-TEST

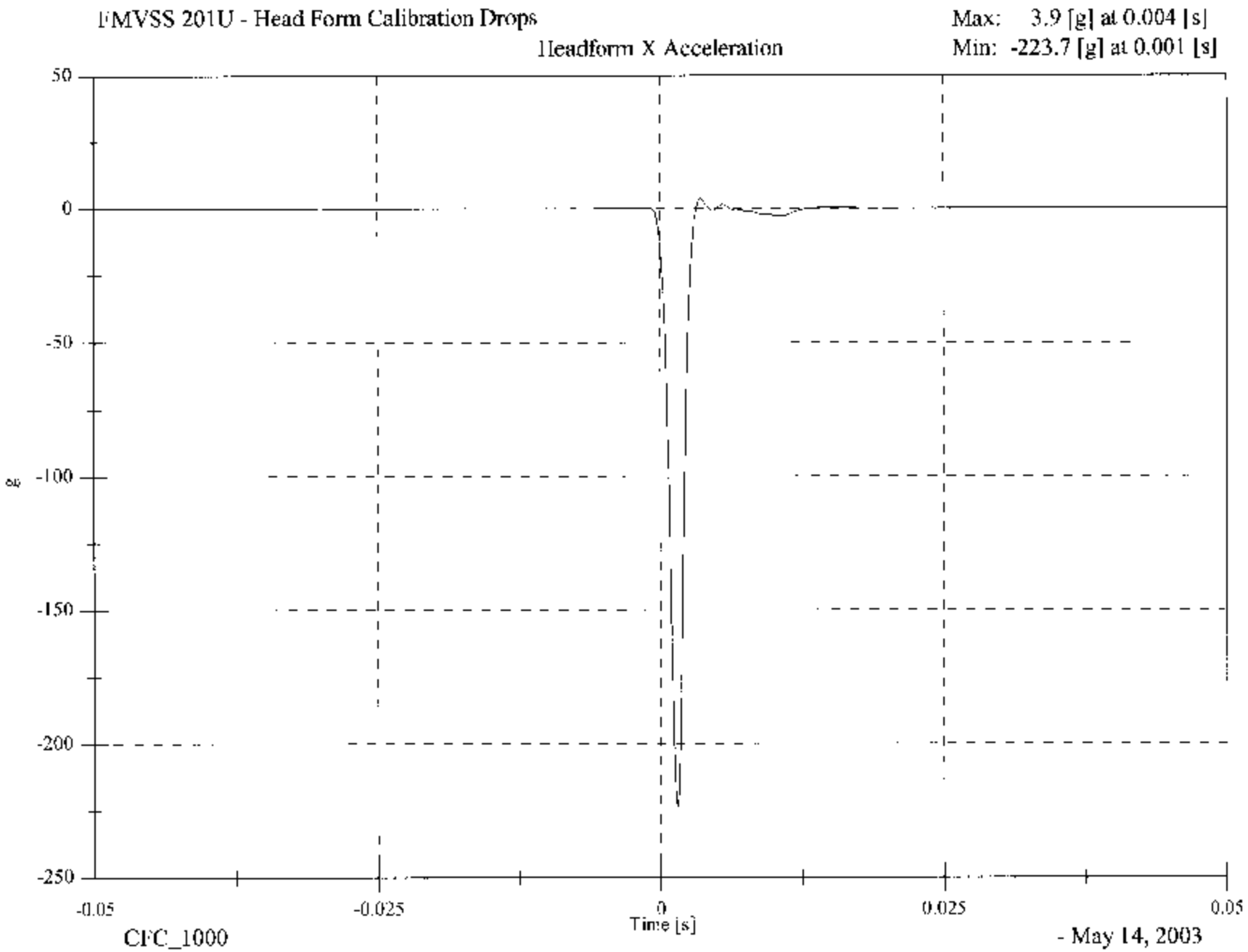
MANUFACTURER:	FIRST TECHNOLOGIES SAFETY SYSTEMS	
SERIAL NUMBER:	805	
CALIBRATION DATE:	MAY 14, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	19°C to 26°C	22
RELATIVE HUMIDITY	10% to 70%	33
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	250.8
PEAK LATERAL ACCELERATION	15 Gs Maximum	3.3
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

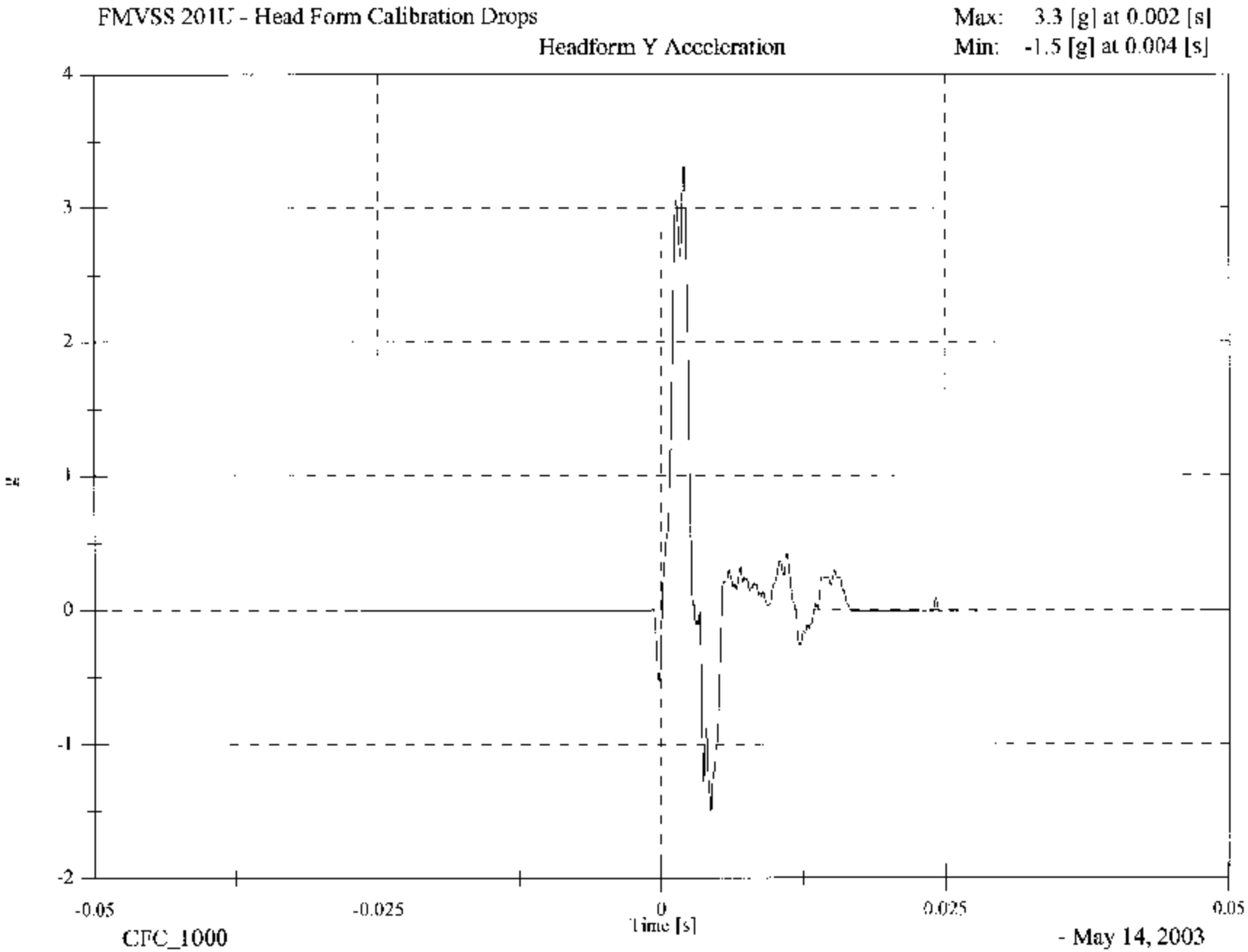
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	J38127	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	J37980	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	J37854	3/03	9/03

REMARKS:

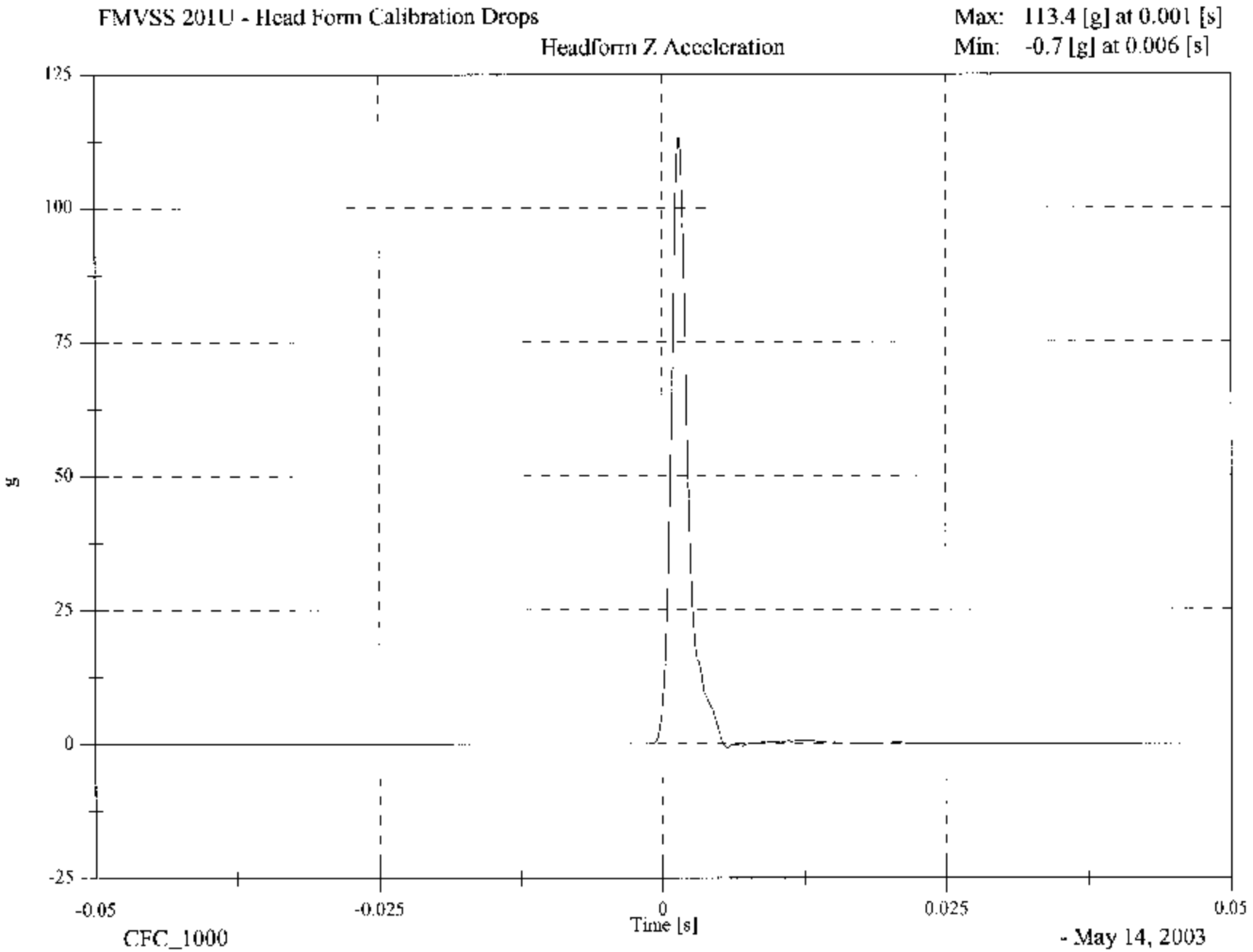
C30112 POST-TEST 0805 HEAD FORM IMPACT PLOT #1



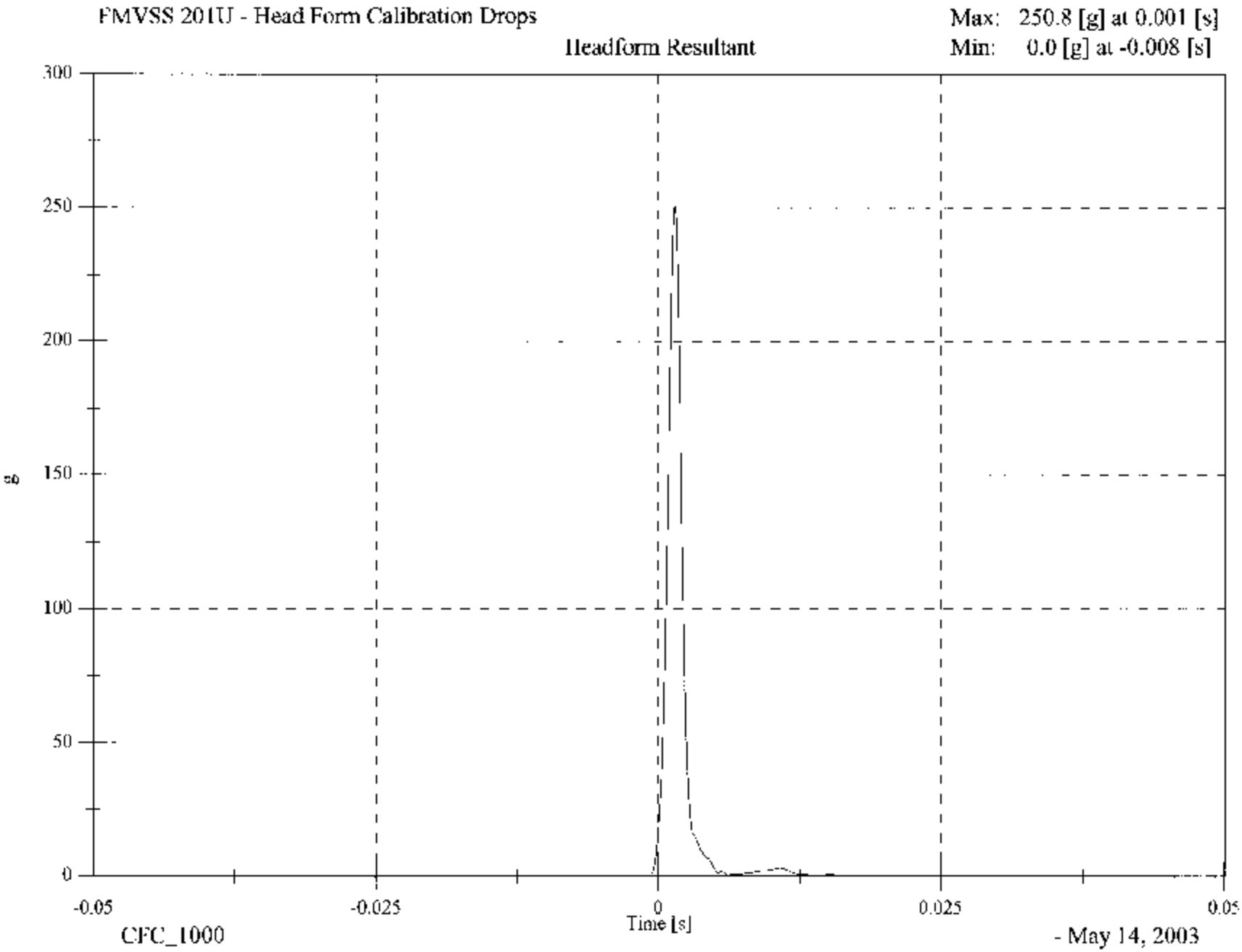
C30112 POST-TEST 0805 HEAD FORM IMPACT PLOT #2



C30112 POST-TEST 0805 HEAD FORM IMPACT PLOT #3



C30112 POST-TEST 0805 HEAD FORM IMPACT PLOT #4



PART 572L
HEAD DROP POST TEST

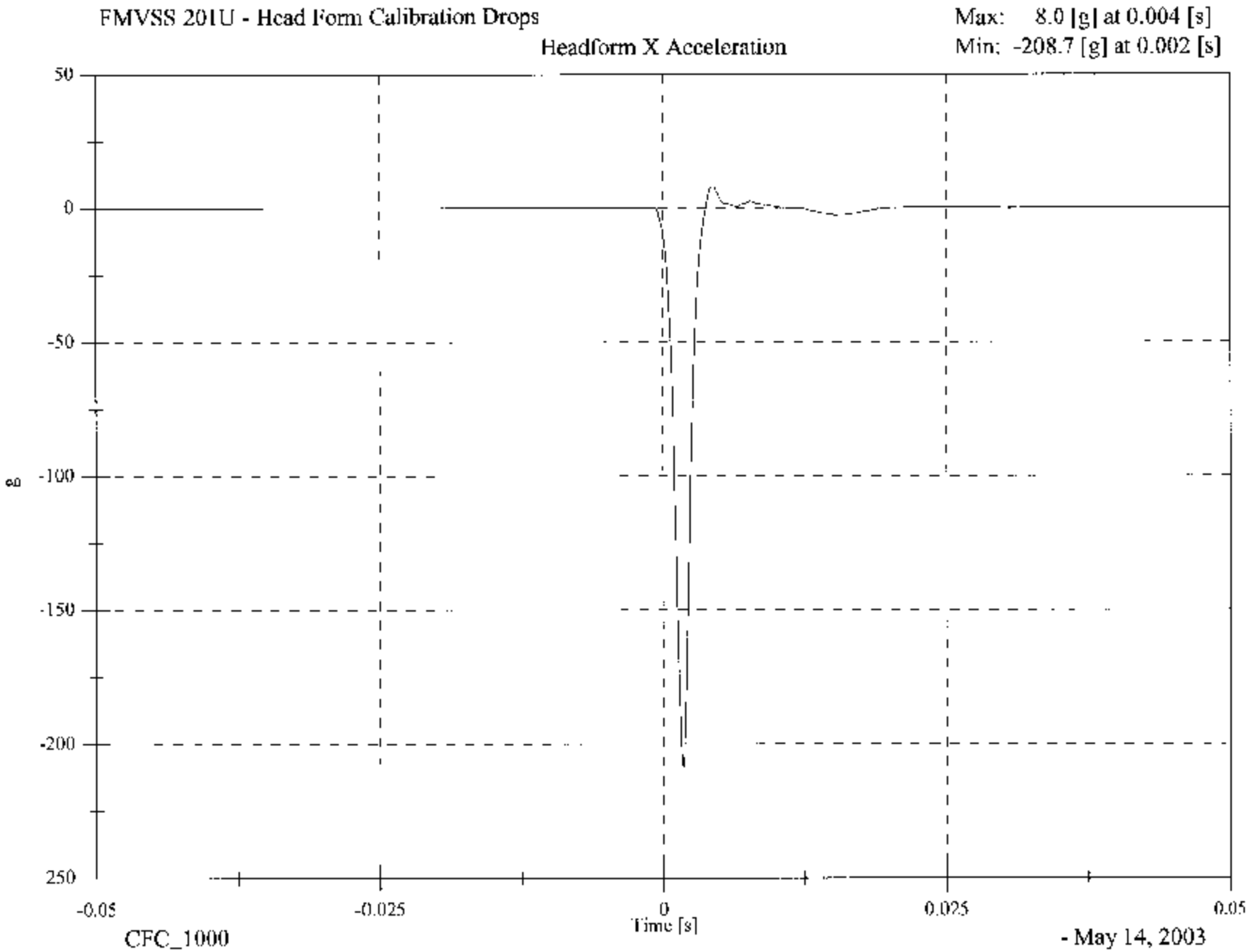
MANUFACTURER:	APPLIED SAFETY TECHNOLOGIES CORPORATION	
SERIAL NUMBER:	1255	
CALIBRATION DATE:	MAY 14, 2003	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	9°C to 26°C	22
RELATIVE HUMIDITY	10% to 70%	33
PEAK RESULTANT ACCELERATION	225 Gs to 275 Gs	231.8
PEAK LATERAL ACCELERATION	1.5 Gs Maximum	1.6
IS ACCELERATION CURVE UNIMODAL?	YES	YES

HEAD ACCELEROMETER CALIBRATION INFORMATION

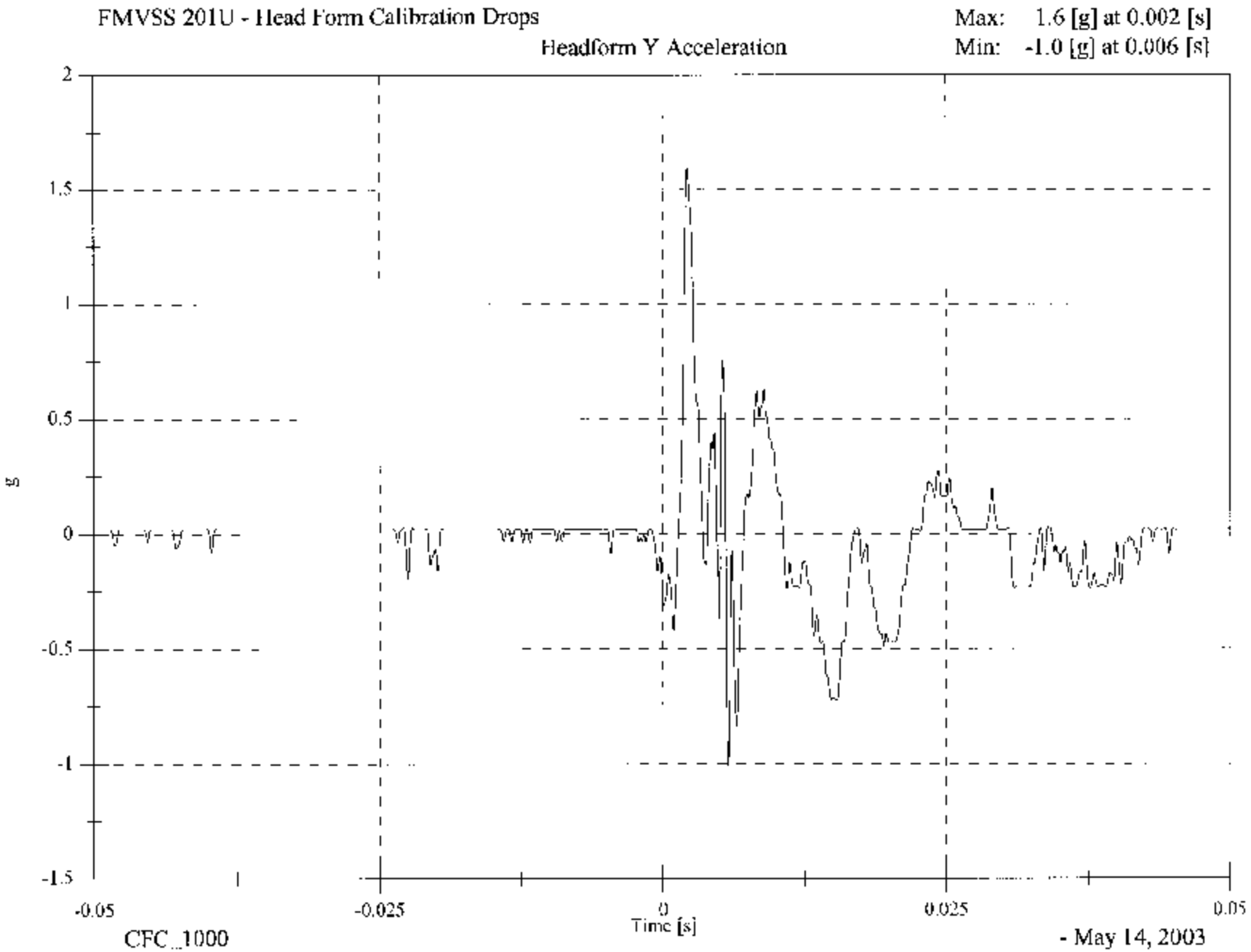
I.D. NUMBER	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
1 -LONGITUDINAL	ENDEVCO	7264-2000T	J41006	3/03	9/03
2 - LATERAL	ENDEVCO	7264-2000T	J40994	3/03	9/03
3 - VERTICAL	ENDEVCO	7264-2000T	J41007	3/03	9/03

REMARKS:

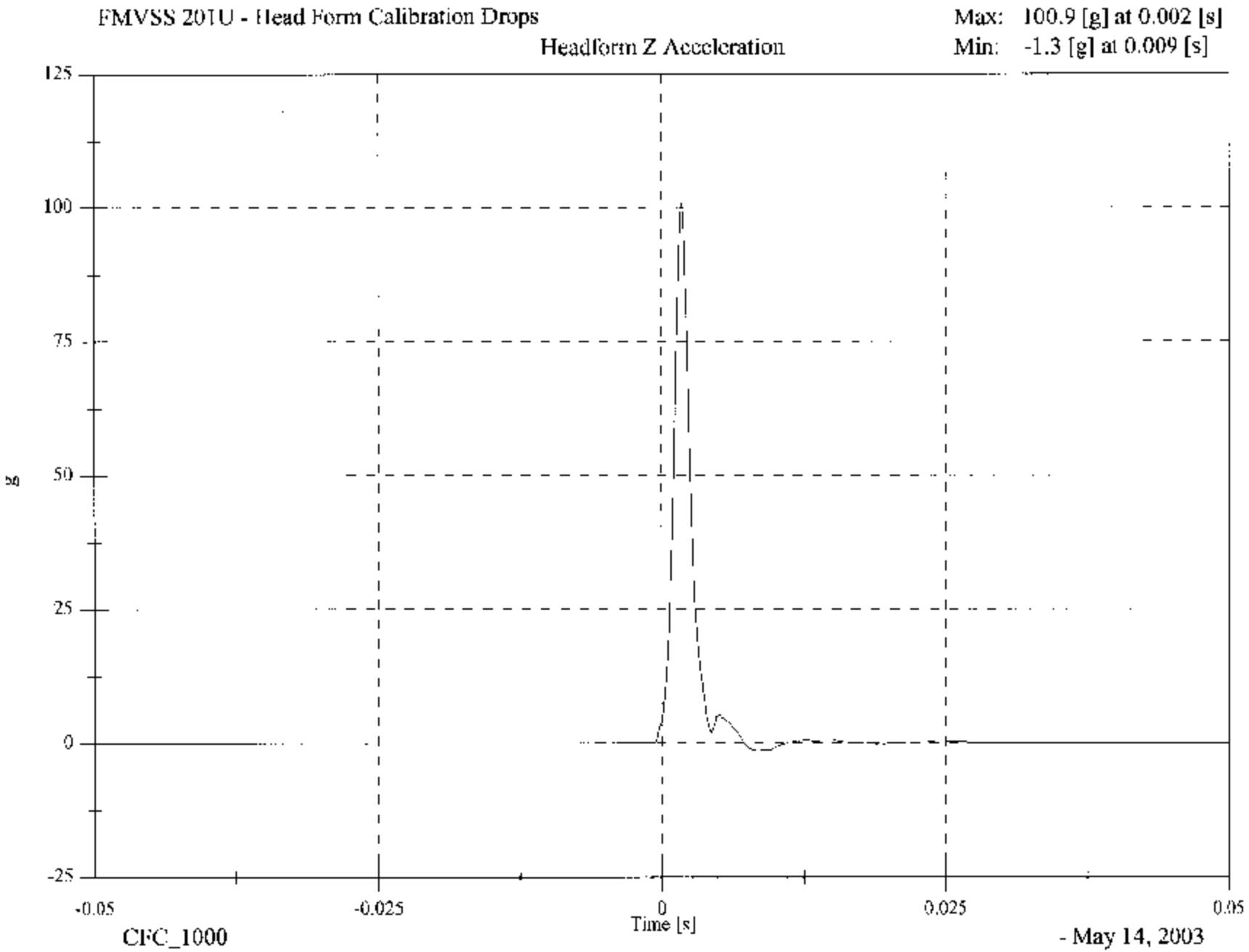
C30112 POST-TEST 1255 HEAD FORM IMPACT PLOT #1



C30112 POST-TEST 1255 HEAD FORM IMPACT PLOT #2



C30112 POST-TEST 1255 HEAD FORM IMPACT PLOT #3



C30112 POST-TEST 1255 HEAD FORM IMPACT PLOT #4